

EYES THAT NEVER SLEEP

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG'D. TRADE MARK, GREAT BRITAIN, NO. 41042E

REG. U.S. PAT. OFF.

NOV.
25 CENTS

SEE PAGE 679

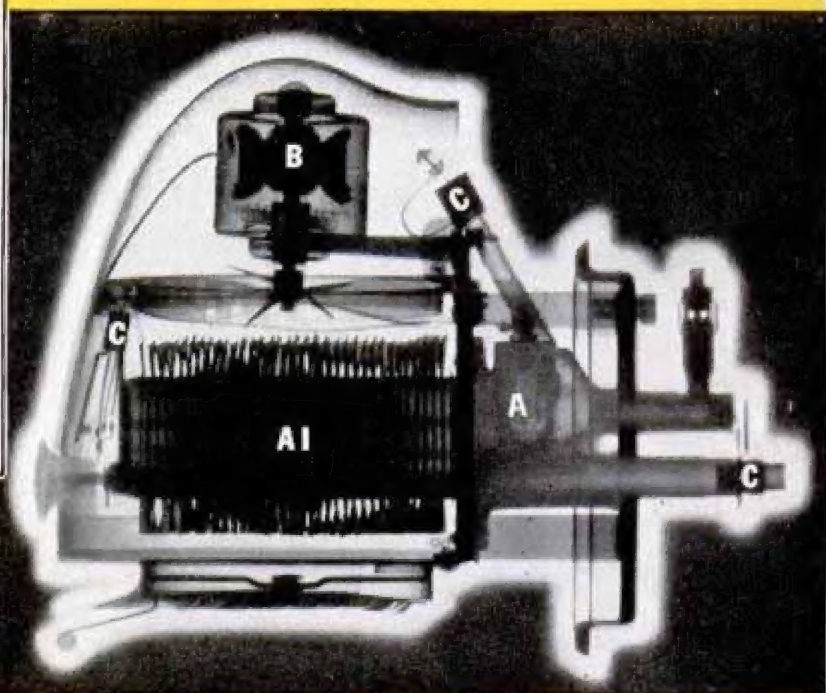


UTTERLY NEW CAR HEATER HEATS HOT IN 90 SECONDS



Actual X-ray of South Wind heater by General Electric X-Ray Corp. Vacuum from manifold draws gasoline into sealed combustion chamber A—then draws burned gases thru finned radiating labyrinth A1 and out thru engine manifold. Fan B blows air over heated fins and thru car. Note automatic controls C.

● **BURNS GASOLINE** In Patented Sealed Metal Chamber . . Guaranteed To Give **MORE HEAT—FASTER!**



● Here's the most amazing development in car-heater history! An utterly *new kind of heater* that gives billows of warmth in 90 seconds by the stop watch, long before your engine warms up! And that gives *more heat, too!*

This Stewart-Warner South Wind Heater is hotter and faster because it works a brand new way—burns gasoline in a *patented, sealed metal chamber* at an average cost of only $\frac{3}{8}$ of a cent an hour. And its safety is proved by the famous seal of Underwriters' Laboratories, Inc.

Vacuum from the manifold draws gasoline into the sealed chamber, and draws out the burned gases. An electric igniter lights the heater *automatically*—

then *shuts off automatically*, so there's no heavy drain on the battery. A single control knob starts and stops the heater, and adjusts temperature.

Installation is simplified because the South Wind Heater is *totally independent* of the cooling system. There's no hose cutting, no extra thermostats to buy, no added loss of anti-freeze through increased leakage or evaporation.

Let this amazing invention insure *billows of warmth within seconds* in your car this winter. See your car dealer, garage or accessory dealer now.

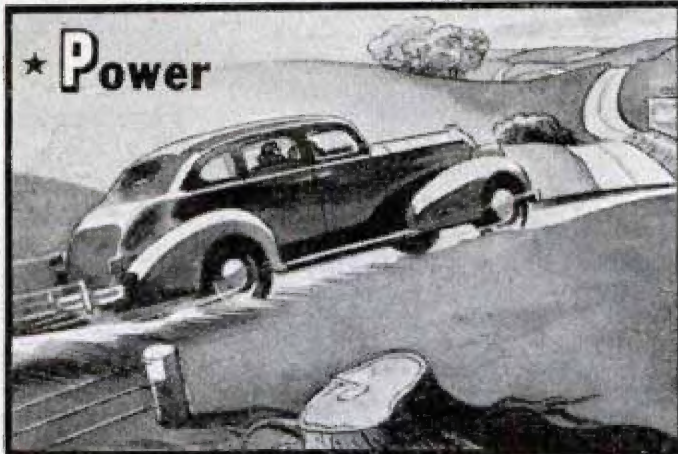
STEWART-WARNER CORPORATION, CHICAGO, ILL.

STEWART-WARNER

South Wind
REG. U. S. PAT. OFF. **CAR HEATER**

Watch your **P's** and **Q's** this winter

RE-WIRE NOW WITH A COMPLETE SET OF PACKARD 440 SPARK PLUG WIRES



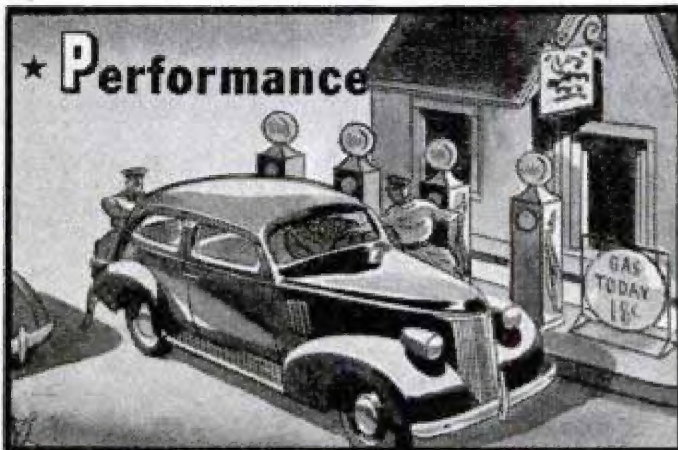
★ Power

A cold motor can be as stubborn as a mule when you try to start it on the weak, wasted spark that results from leaking wires and corroded battery terminals. Give your battery and your temper a break this winter. Install Packard Four-Forty ignition cables and Packard No. 1 gauge battery cable.

If you have driven over 10,000 miles without replacing spark plug wires, the chances are you are not getting full power from your car. To get full power . . . new pep and pick-up . . . install a complete set of Packard Four-Forty ignition cable today as the first step in your fall tune-up.



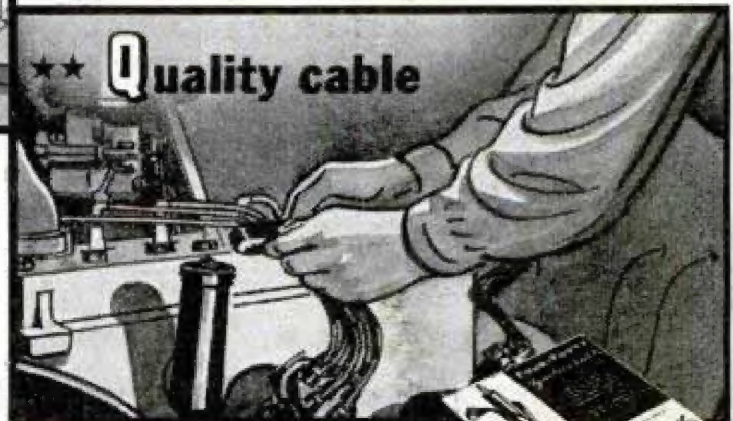
★★ Quick-starting



★ Performance

Why choose Packard Four-Forty? Because it's a new, different, *quality* cable. Its secret-formula, super-resistant sheath gives Packard Four-Forty far greater cable life than the old cotton-braid and lacquer wires. A complete set will save you more than it costs.

Worn, oil-soaked or cracked insulation robs you of from two to four miles per gallon through mis-firing and cross-ignition. Instead of *throwing away* one gallon out of every eight you buy this winter, take a few minutes off and have your service station install a set of Packard Four-Forty.



★★ Quality cable

Packard
REG. U.S. PAT. OFF.
TRADE MARK

PACKARD ELECTRIC DIVISION
General Motors Corporation, Warren, Ohio

THE STANDARD WIRING EQUIPMENT
OF THE AUTOMOTIVE INDUSTRY



HERE'S AN EASY WAY TO GET
MORE LIGHT
 AT NO EXTRA COST

15¢

60-watts and smaller
 75 and 100-watt sizes . . 20c

... use the new, brighter **G-E MAZDA LAMPS**

Thanks to a new high-efficiency filament and other improvements recently made possible by MAZDA lamp research, G-E MAZDA lamps give you **MORE LIGHT** than ever this year . . . at

no extra cost for electric current and with no increase in price. For example, the 60-watt size gives you 10% more light than it did last year, yet it still costs only 15¢.

LIGHT UP FOR NEW EYE-COMFORT

Begin to enjoy new eye-comfort tonight: Fill up empty sockets and replace burned out bulbs with brand-new G-E MAZDA lamps of the proper size.

Get a fresh supply of these new, brighter

bulbs today. And when you buy, look for the G-E trademark. Then you will be sure to get lamps that **STAY BRIGHTER LONGER** than inferior substitutes. General Electric Co., Nela Park, Cleveland, O.

GENERAL  ELECTRIC
MAZDA LAMPS

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Popular Mechanics Magazine

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

November, 1937

Vol. 68, No. 5

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Chemistry and You

MANY people consider chemistry an abstract science quite remote from their daily lives. But from the time you brush your teeth in the morning until you wind the alarm clock at night, you use products created, in whole or in part, by the magic hand of the chemist. And if all of chemistry's gifts to mankind were suddenly snatched away, most of our material possessions would vanish with them. From such common things as air, water, coal, salt and lime the chemist today is producing a multitude of man-made materials much better suited to our needs than the simple natural substances on which our forefathers depended for food, shelter and clothing. In the December issue you will find the first of four articles dealing with chemistry's contributions to civilization. The author is Dr. C. M. A. Stine, vice-president of E. I. du Pont de Nemours and Company and his dramatic story of scientific achievement is illustrated with eight pages of Coloroto pictures.

Next Month

CHRISTMAS comes but once a year and lasts just one day. But you can extend next Christmas into next year by making a permanent record of the festivities with your camera. An article next month explains how to plan your Christmas snapshots in advance and how to take them.

Ghost Town Revival

GHOST towns of the mining country abandoned when the gold rush died are coming back to life under the spur of higher-priced gold. Air-conditioned stores are springing up beside the tottering ruins of old business blocks. Ancient livery stables are being torn down to make room for gasoline filling stations. The revival of these old towns and of mining forms the basis for an interesting article in the December issue.

Inventing Laughs

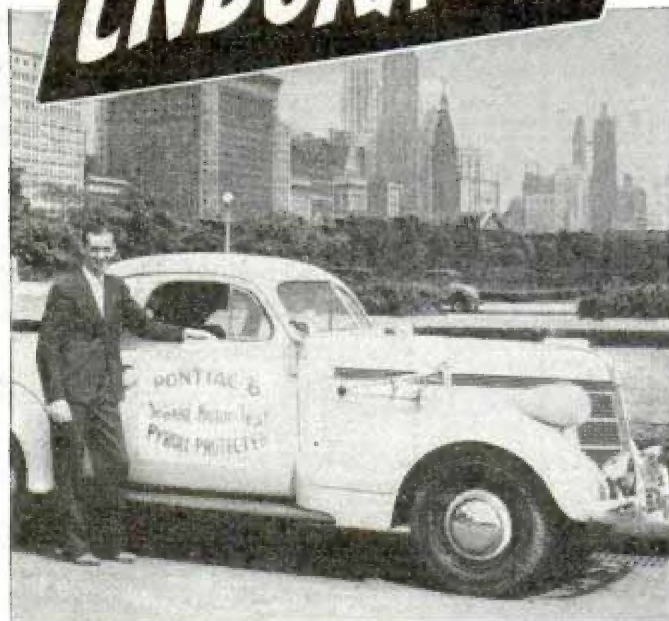
TIME was when circus clowns depended mostly on pantomime and ridiculous costumes to make you laugh. But today it takes more than that. It takes mirth-provoking ideas staged with the aid of ludicrous and often intricate "props," the latter frequently the brain children of amateur "inventors," friends and acquaintances of the funny men. Next month a man who makes clown "props" as a hobby tells you how he does it—and why.

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This One



PYROIL GIVES YOUR CAR ENDURANCE



Ted Ellis, Test Driver, at Half Way Point in Cross Country, Sealed Crankcase Test

In July weather—from Los Angeles to Chicago and return—reaching elevations of 9000 feet, temperatures of 45°—touching sea levels with 110° temperatures—Ted Ellis, Cross Country Test Driver, whipped this Pyroil protected new car a distance of 4721 miles, establishing a remarkable record for performance. With crankcase sealed, Ellis used less than 2 quarts of oil! Enjoyed peak performance. Had no motor trouble, absolute running perfection!

Pyroil gives your car the ability to take strains. It safeguards when your car undergoes excessive abuse. It saves you money in offsetting repairs, in gaining better mileage, in preserving your car.

Use Pyroil regularly. Three ounces in the gasoline every 200 to 250 miles. Two ounces to each quart of oil in your crankcase. Sold the world over. Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 511 Pyroil Bldg., LaCrosse, Wisconsin, U. S. A.



PYROIL HAS BEEN TESTED BY POPULAR MECHANICS AND IS USED BY POPULAR MECHANICS' PRESSES AND EQUIPMENT.

DISTRIBUTORS:

Check and mail coupon for facts of our unusual Sales Opportunity for you. Start now!

12-ounce can treats 7 Quarts of Oil.

PYROIL COMPANY

511 Pyroil Bldg., LaCrosse, Wis., U.S.A.

Please send complete Pyroil facts.

☐ Also send details of your plan for Distributors.

Name.....

Address.....

City.....County.....State.....

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MILLIONS MORE Take Right Turn

More and more motorists each year discover it costs less to be carefree...that it's sound economy to buy the anti-freeze that's *guaranteed* and side-step the grief and expense of freeze-up, boil-away and rust-clogging. • Price-per-gallon means nothing. It's *cost-per-winter* that counts. Your dealer can tell you how much "Prestone" anti-freeze you will need for all-winter protection, but *no one* can foretell your needs in boil-away anti-freezes.

TAKE-A-CHANCE
ANTI-FREEZE
THIS WAY
TO
BOIL-AWAY
FREEZE-UP
AND RUST

TO ALL-WINTER
PEACE-OF-MIND
VIA 
GUARANTEED
"PRESTONE"
ANTI-FREEZE

NATIONAL CARBON COMPANY, INC.

specifically

GUARANTEES

that "Eveready" "Prestone" anti-freeze, if used according to printed directions, in normal water cooling systems, will protect the cooling system of your car against freezing and clogging from rust formations for a whole winter; also that it will not boil away, will not cause damage to car finish, or to the metal or rubber parts of the cooling system, and that it will not leak out of a cooling system tight enough to hold water.

NATIONAL CARBON COMPANY, INC.

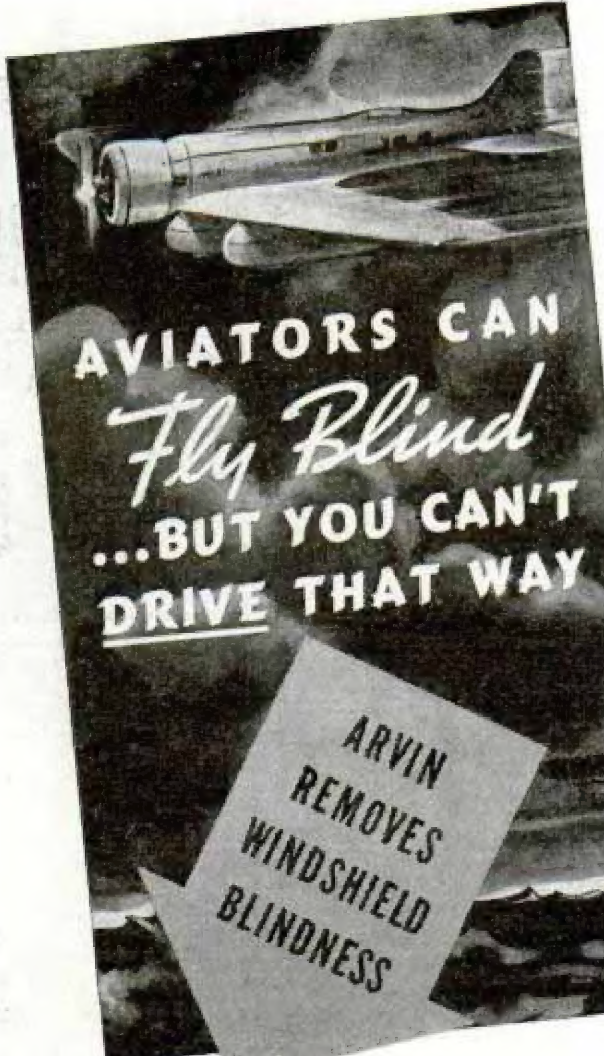
GENERAL OFFICES: NEW YORK, N. Y. BRANCHES: CHICAGO • SAN FRANCISCO
UNIT OF UNION CARBIDE  AND CARBON CORPORATION

No other anti-freeze gives you a written guarantee like the one above. Read it, now. Order your "Prestone" anti-freeze today.

\$2⁹⁵
A GALLON

Buy "Prestone" anti-freeze from dealers who are properly equipped to service your car for winter driving.





**AVIATORS CAN
Fly Blind
...BUT YOU CAN'T
DRIVE THAT WAY**

**ARVIN
REMOVES
WINDSHIELD
BLINDNESS**

1
DEFROSTS THE
WINDSHIELD

2
CIRCULATES
MORE HEAT

3
WARMS THE FEET



It's more than a car heater



The new built-in Arvin System does a 3-way job of defrosting, foot-warming and circulating more heat throughout your car. Special Duo-Flow model for Ford V-8, Tailor-Fit models for General Motors and Chrysler-built cars. Model shown, \$15.95, with two defroster and two foot-warmer outlets. Defroster fittings slightly extra. **\$9.95** Genuine Arvin Heaters for all cars, low as

NOBLITT-SPARKS INDUSTRIES, INC. • COLUMBUS, INDIANA
Dole Thermostats Assure Maximum Heater Efficiency



ARVIN
CAR HEATING SYSTEM

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TODAY...

Almost Broke!

Yet tomorrow Tom Smith will be on his way toward being a really successful man . . .

SOMEWHERE there is a Tom Smith—that name is as good as any—who is practically flat broke, back on his heels and discouraged today. Perhaps he's in debt. Perhaps, as far as his job is concerned, he's in a rut. Perhaps he's just a victim of these trying times. Yet—he still has vision, imagination. And—ambition. He still believes that he's going *somewhere* . . . somehow, some way, some time. He hasn't given up hope. He still believes in success and opportunity.

Tom Smith will read this advertisement. No—there is a better way of saying it. Tom Smith *will study* this advertisement. He will read it once, then again, then yet again. It will strike a responsive chord somewhere within him. It will stir his dormant ambition, give wings to his imagination, set his vision afire. And he will *act!* As though Hope—as swift and powerful as lightning when it strikes—had suddenly taken possession of him, he will take advantage of the opportunity this advertisement offers him. And then—

Six months from now, his friends will say, "Have you heard about Tom Smith? Yes—just got a new job with an increase in salary." And two years later, the business journals in his field may report, "Thomas Smith Appointed Manager." And five years . . . or ten . . . or fifteen years hence, the sign on his office door may read "Thomas Smith, President."

All because Tom Smith had the vision, the imagination, the ambition, to recognize the significance of this advertisement. Because he had the foresight to see that here was his way to opportunity.

* * *

This page advertises the training of LaSalle Extension University. It is a unique university in many respects.



It utilizes Uncle Sam's postal service in its contacts with its students. It is the university for those men and women who work by day in every type of business and profession. It is the university of the clerk ambitious for success in accountancy. It is the university of the business man with an eye upon an executive position. It is the

university of men and women, young and middle aged, who wish to become accountants, bankers, sales managers, traffic experts or specialists in some one of twenty different fields. In short, it is the university for ambitious people, determined to succeed, who recognize that only by thorough specialized training can they reach their objectives.

In the history of LaSalle Extension University, there have been more than 850,000 such men and women. They have gladly substituted night hours of study for night hours of aimless pleasure. They have sacrificed hours of minor enjoyment to reach years of major success. They have studied hard—accumulated the accurate, comprehensive and practical training LaSalle offers by its famous Problem Method—thus wresting from Life the success which long before many had thought was not for them.

The LaSalle Method is comprehensive, yes. It is accurate, up-to-the-minute and alive. It is invaluable training. But above all things, it is a Road Toward Success. It is not an easy road. It is not the road for sluggards, for those who refuse to sacrifice and work. Rather, it leads to their destination only those who have the will to *finish* what they have once *begun*.

* * *

Perhaps you think that prophecy of Tom Smith's career mentioned above is pure fantasy. Perhaps you feel it is solely the product of an advertising writer's imagination. If such are your beliefs, you are wrong. For that prophecy is based upon past experience—

The past experience of thousands of discouraged Tom Smiths who read just such an advertisement as this years ago. Tom Smiths with vision and ambition and imagination who accepted LaSalle's offer of one of the booklets listed below. And—who found the booklet so intriguing, so full of hope, that they enrolled in LaSalle . . . and as the months passed, they found themselves rising out of their rut, reaching toward more attractive and better-paying jobs. Finally, achieving rich and deserved success in their chosen lines.

Tom Smith, wherever you are, whoever you are, whatever are your ambitions—here is your opportunity! Are you going to pass it by?

LA SALLE EXTENSION UNIVERSITY, Dept. 1164-R, Chicago

I am in earnest about my success and I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked.

- | | |
|--|--|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Industrial Management |
| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Modern Foremanship |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Personnel Management |
| <input type="checkbox"/> Modern Salesmanship | <input type="checkbox"/> Business Correspondence |
| <input type="checkbox"/> Commercial Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Law: Degree of LL. B. | <input type="checkbox"/> Effective Speaking |
| <input type="checkbox"/> Expert Bookkeeping | <input type="checkbox"/> Office Management |
| <input type="checkbox"/> C. P. A. Coaching | <input type="checkbox"/> Stenotypy |

Name.....Age.....

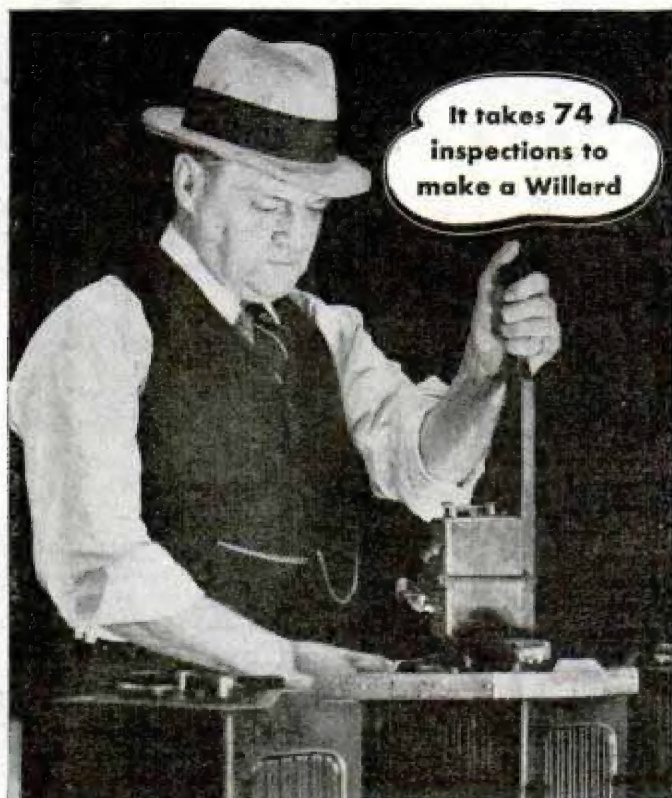
Position.....Address.....

La Salle Extension University

When writing to advertisers please mention Popular Mechanics

Ask for one of these booklets—or a similar one on your own field of business. They are free!





Willard's final electrical test protects millions

• "Because this final electrical test we give to all Willard Batteries protects you...might even save your life or the lives of your family in an emergency — we inspectors take our jobs pretty seriously. Only batteries that you can depend on get our O. K.

"Large fleet owners, railroads and hospitals adopt Willard Batteries because of the way Willard does things...every part must be right, every battery must pass 74 inspectors before it leaves our plant."

At Willard, final inspection is vitally important. The men in charge of this department have full power to reject any battery or group of batteries, or even to stop production, if necessary.

The same infinite care covers every step of building these famous batteries. And that's why Willards last longer, crank faster, and don't let you down.

Service records from car owners all over the nation show that Willards Cost Less to Own.

There are 42,000 Willard dealers conveniently located ready to serve you. When you need a battery...play safe...buy a Willard.

WILLARD STORAGE BATTERY CO.
Cleveland • Los Angeles
Toronto, Canada



Willards

COST LESS TO OWN!

**Because they...last longer...
crank faster...don't let you down**

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IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described, in order to avoid possible liability for patent infringement.

SPURS OR WISHBONES?



• Overcoming obstacles on the path to success is something like "busting" bronchos. A man has to have nerve, determination, and courage. Above all, he must know how! And this is truer today than ever before.

I. C. S. can't supply the first three qualities. But it can—and will—provide

the knowledge and training needed to get ahead!

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Opportunity 1
Homes
Think what it could have meant to you to be in on the electrification of America, when homes first were being wired! Today, *millions* of homes offer similar opportunities for thoroughly trained Air Conditioning engineers.

Opportunity 2
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Stores
Tribune Tower (Chicago), J. L. Hudson (Detroit), and other famous office buildings and stores are setting a pace that *forces* others to consider Air Conditioning.

Opportunity 3
Factories
Air Conditioning speeds production, reduces payroll turnover and, in many industries, stabilizes *quality* so that factories **MUST** Air Condition in order to cut costs and meet competition. And there are 200,000 factories in America!

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Public
Carriers
The Burlington Route is going 100% Air Conditioning. All major systems are installing fast as possible. Airliners and buses are following suit.

Opportunity 5
Institutions
Hospitals, sanitariums, old folks' homes—all find Air Conditioning vitally important to health. Hay fever and asthma patients virtually **MUST** have Conditioned Air *wherever* they are—in institutions, at work, traveling or at home.

In 1905, Automobile manufacturers produced 40 million dollars' worth of cars and thought they had had a good year—but in 1935, Automobiles had become a 2 *billion* dollar industry. In 1936, Air Conditioning did a 49 million dollar business—while in the *first 5 months* of 1937 it has skyrocketed to 50 million! Who dare predict what it will do 30 years from now, in 1967? The Automobile industry in 30 years went from 40 *millions* to 2 **BILLIONS**. What is to stop Air Conditioning?

Stop and think: What men benefited most in the Automobile industry—those who waited until it was nearing its peak, or those who saw their opportunity, got in while the industry was young, and enjoyed the advantage of growing with it?

AIR CONDITIONING Beckons Trained Men

Today there are all too few who are trained to design, manufacture, estimate and install Air Conditioning equipment. It takes time to develop a new industry—machines have to be made—men have to be *trained* in all its many branches. Here's a *real* opportunity for ambitious men!

What do you know about Air Conditioning *today*? Of what real value would your services be to the industry? On the other hand, if you will study up in your spare time on the principles of design, manufacture, estimating and making installations, you won't be far behind the leaders in this new industry. And you will be *away out in front* of the men who just can't decide to get started until every Tom, Dick and Harry (and all their friends) are already in it.

Stake Your Claim NOW!

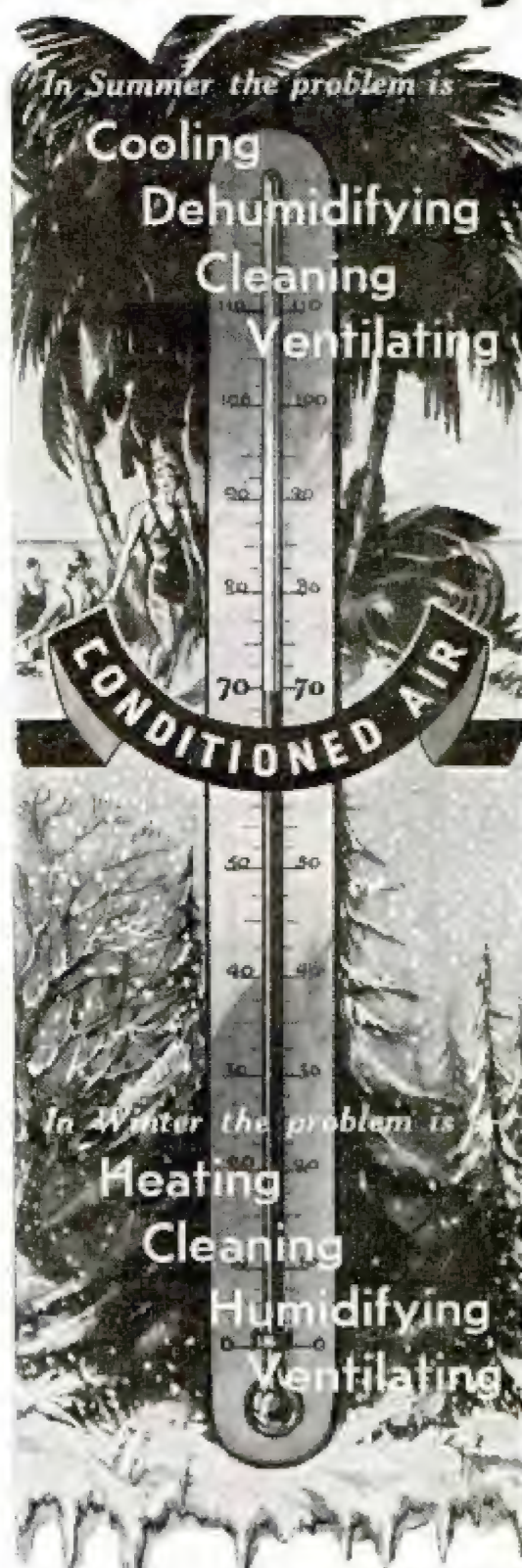
Any line that is nearing its peak in production is always nearing the saturation point in number of jobs open. If I were a young man looking for *real opportunity*, Air Conditioning certainly would be my choice. How about *you*? Do you want to prepare yourself *at home*,

for a young, growing business where there is comparatively only a handful of men competent to handle the jobs now open—where there is practically no competition—and where every man will forge ahead in direct proportion to his *training* and experience? As in the old "Gold Rush" days, it is wise to arrive early and *stake your claim*.

A 32-page booklet on home study is yours for the asking—"YOUR FUTURE JOB, AIR CONDITIONING"—an interesting story of *why* this new industry will offer steady work, good pay, promotion and special opportunities for the *trained* man where he need not worry about being old at 40.

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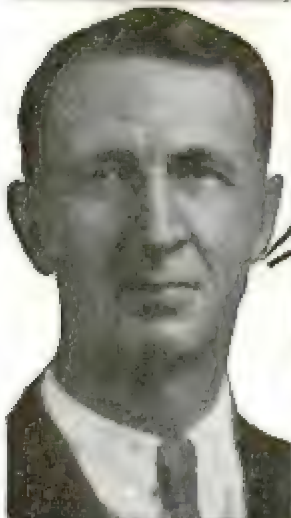
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Do you want to make more money? Radio offers you many opportunities for well-paying spare time and full time jobs. You don't have to give up your present job, leave home or spend a lot of money to become a Radio Expert

Many Radio Experts Make \$30, \$50, \$75 a Week

Radio broadcasting stations employ engineers, operators, station managers and pay up to \$5,000 a year. Spare time Radio set servicing pays as much as \$200 to \$500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as \$30, \$50, \$75 a week. Many Radio Experts operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to \$6,000 a year. Radio operators on ships get good pay, see the world besides. Automobile, police, aviation, commercial Radio, and loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I trained have good jobs in these branches of Radio. Read their statements. Mail the coupon.

There's a Real Future in Radio for Well Trained Men

Radio already gives good jobs to more than 300,000 people. In 1936, Radio enjoyed one of its most prosperous years. More than \$500,000,000 worth of sets, tubes and parts were sold—an increase of more than 60% over 1935. Over a million Auto Radios were sold, a big increase over 1935. 24,000,000 homes now have one or more Radio sets, and more than 4,000,000 autos are Radio equipped. Every year millions

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of these sets go out of date and are replaced with newer models. More millions need servicing, new tubes, repairs, etc. A few hundred \$30, \$50, \$75 a week jobs have grown to thousands in 20 years. And Radio is still a new industry—growing fast!

Many Make \$5, \$10, \$15 a Week Extra In Spare Time While Learning

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Act Today. Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It points out Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL THE COUPON in an envelope, or paste it on a penny post card NOW!

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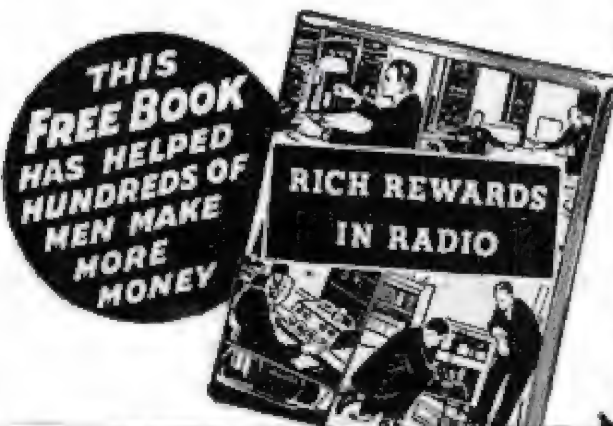
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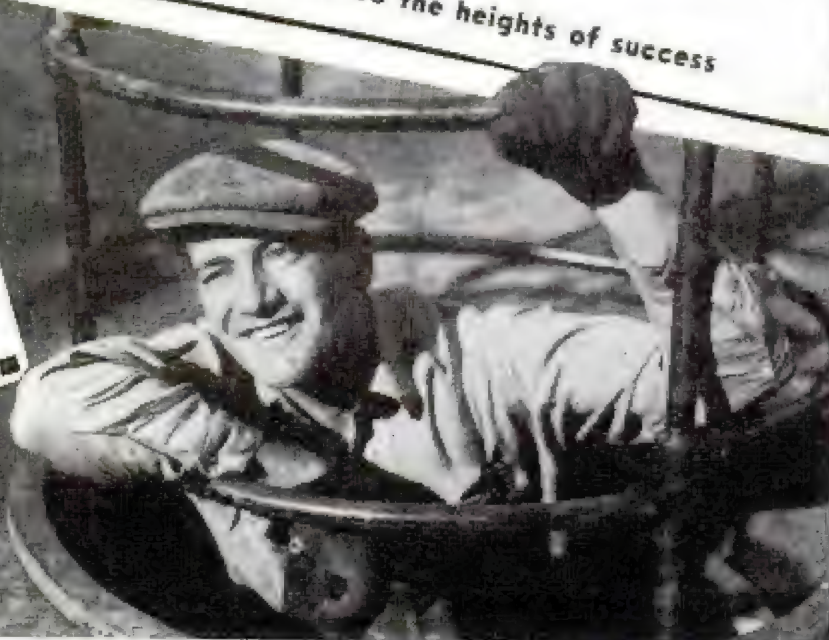
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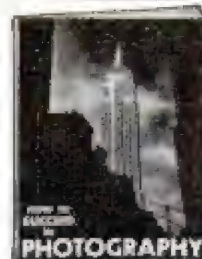
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| <input type="checkbox"/> Electrical Engineer | <input type="checkbox"/> Marine Engineer |
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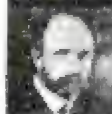
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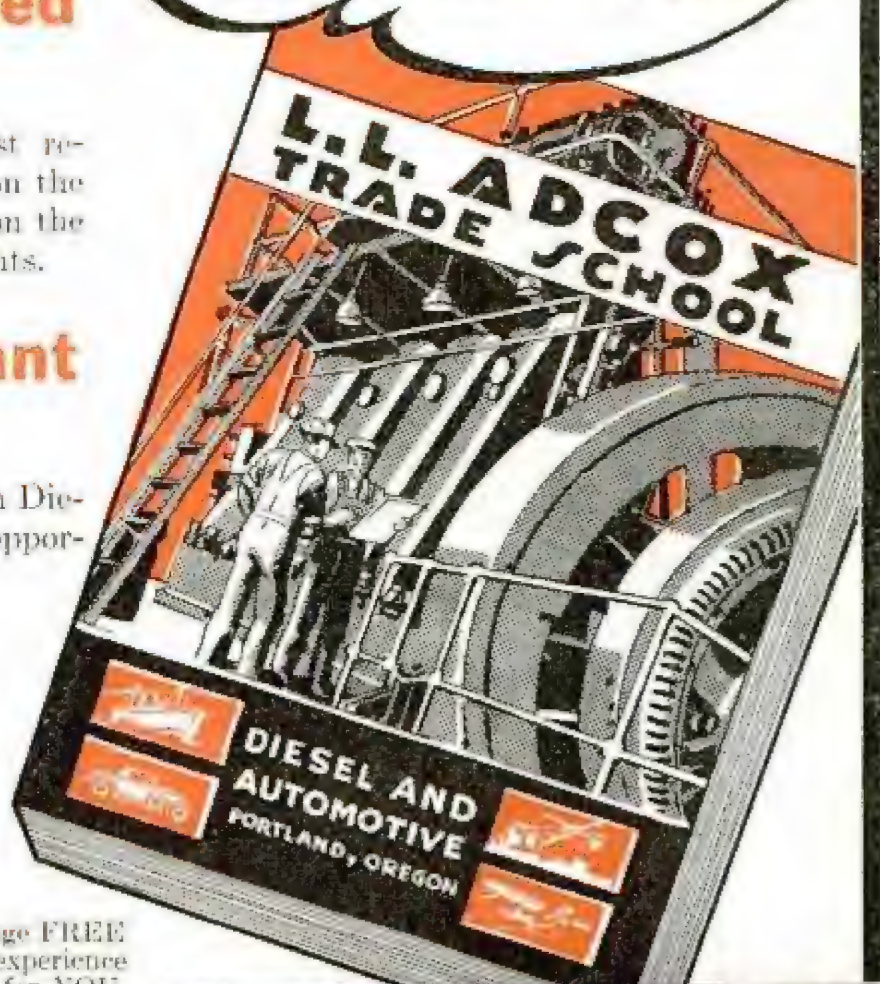
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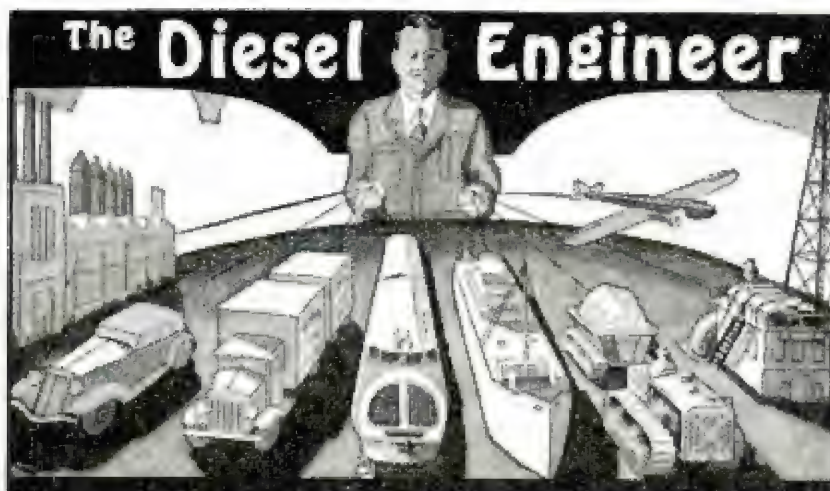
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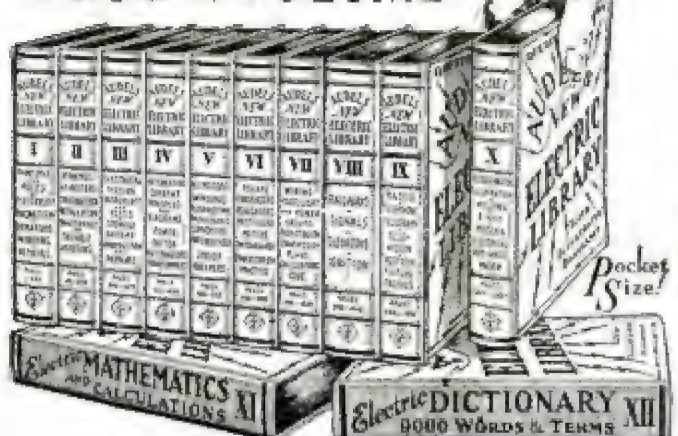
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Remember that for every Edison or Kettering, for every McCormick, DeForest or Atwater Kent—there have been thousands of unknown men whose inventions helped along the wheels of progress and helped the inventors financially at the same time.

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Interesting Points

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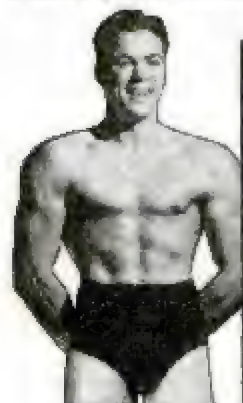
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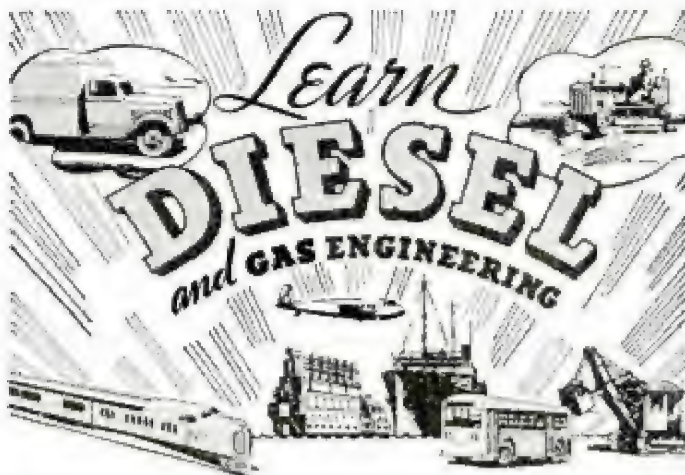
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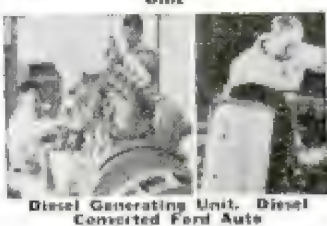
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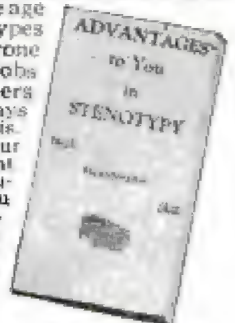
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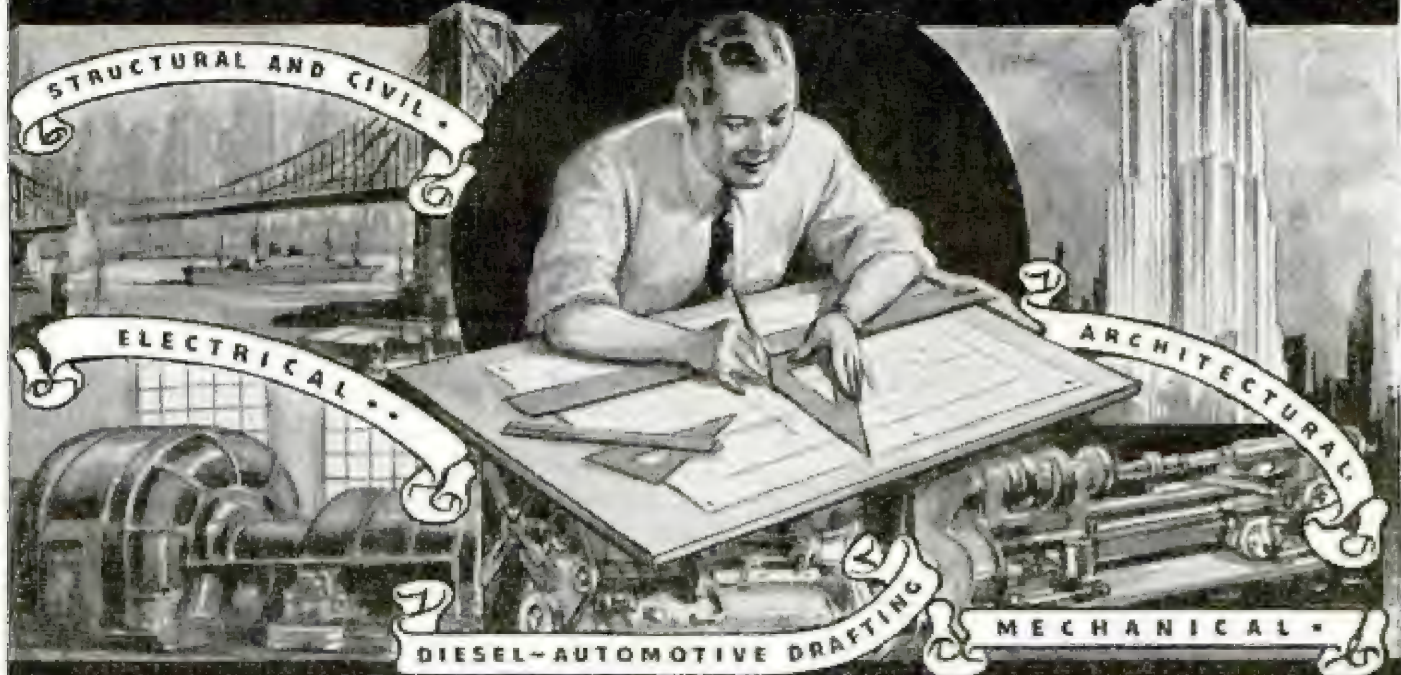
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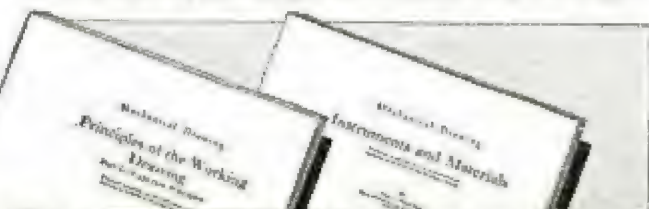
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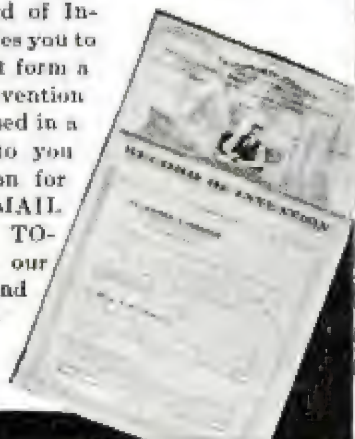
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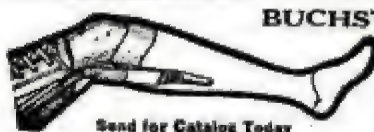
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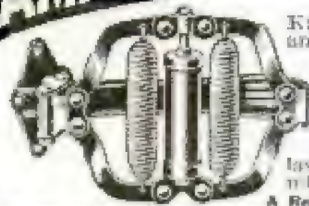


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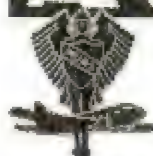
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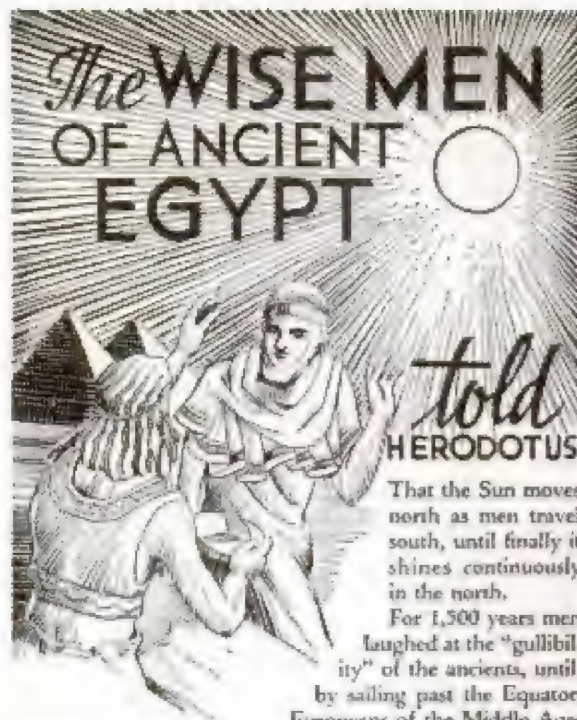
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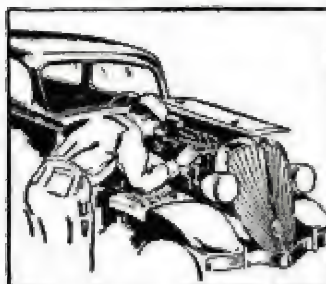


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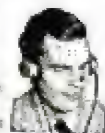
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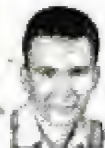
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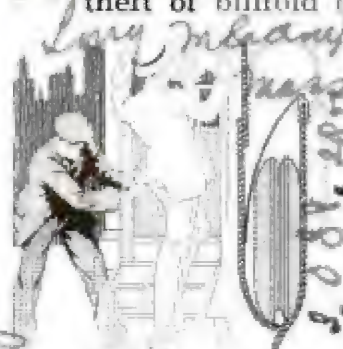
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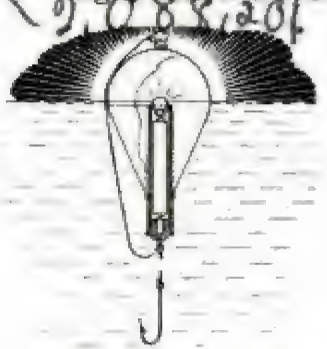
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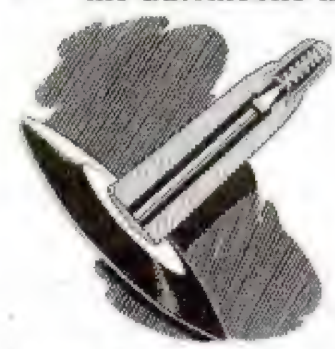
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(Continued to page 64A)

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veterans.

Make no mistake—this is no novelty—no flimsy creation which the inventor hopes to put on the market. You probably have seen nothing like it yet—perhaps never dreamed of the existence of such a device—yet it has already been used by corporations of outstanding prominence—by dealers of great corporations—by their branches—by doctors, newspapers, publishers—schools—hospitals, etc., etc., and by thousands of small business men. You don't have to convince a man that he should use an electric bulb to light his office instead of a gas lamp. Nor do you have to sell the same business man the idea that some day he may need something like this invention. The need is already there—the money is usually being spent right at that very moment—and the desirability of saving the greatest part of this expense is obvious immediately.

Some of the Savings
You Can Show

You walk into an office and put down before your prospect a letter from a sales organization showing that they did work in their own office for \$11 which formerly could have cost them over \$200. A building supply corporation pays our man \$70, whereas the bill could have been for \$1,600! An automobile dealer pays our representative \$15, whereas the expense could have been over \$1,000. A department store has expense of \$88.60, possible cost if done outside the business being well over \$2,000. And so on. We could not possibly list all cases here. These are just a few of the many actual cases which we place in your hands to work with. Practically every line of business and every section of the country is represented by these field reports which hammer across dazzling, convincing money-saving opportunities which hardly any business man can fail to understand.

Profits Typical of
the Young, Growing Industry

Going into this business is not like selling something offered in every grocery, drug or department store. For instance, when you take a \$7.50 order, \$5.63 can be your share. On \$1,500 worth of business, your share can be \$1,167.00. The very least you get as your part of every dollar's worth of business you do is 67 cents—on ten dollars' worth \$6.70, on a hundred dollars' worth \$67.00—in other words two thirds of every order you get is yours. Not only on the first order—but on repeat orders—and you have the opportunity of earning an even larger percentage.

This Business Has
Nothing to Do With
House to House Canvassing

Nor do you have to know anything about high-pressure selling. "Selling" is unnecessary in the ordinary sense of the word. Instead of hammering away at the customer and trying to "force" a sale, you make a dignified, business-like call, leave the installation—whatever size the customer says he will accept—at our risk, let the customer tell himself after the device is in and working. This does away with the need for pressure on the customer—it eliminates the handicap of trying to get the money before the customer has really convinced himself 100%. You simply tell what you offer, showing proof of success in that customer's particular line of business. Then leave the invention without a dollar down. It starts working at once. In a few short days, the installation should actually produce enough cash money to pay for the deal, with profits above the investment coming in at the same time. You then call back, collect your money. Nothing is so convincing as our offer to let results speak for themselves without risk to the customer! While others fail to get even a hearing, our men are making sales running into the hundreds. They have received the attention of the largest firms in the country, and sold to the smallest businesses by the thousands.

EARNINGS

One man in California earned over \$1,600 per month for three months—close to \$5,000 in 90 days' time. Another writes from Delaware—"Since I have been operating (just a little less than a month of actual selling) and not the full day at that, because I have been getting organized and had to spend at least half the day in the office; counting what I have sold outright and on trial, I have made just a little in excess of one thousand dollars profit for one month." A man working small city in N. Y. State made \$10,805 in 9 months. Texas man nets over \$300 in less than a week's time. Space does not permit mentioning here more than these few random cases. However, they are sufficient to indicate that the worthwhile future in this business is coupled with immediate earnings for the right kind of man. One man with us has already made over a thousand sales on which his earnings ran from \$5 to \$60 per sale and more. A great deal of this business was repeat business. Yet he had never done anything like this before coming with us. That is the kind of opportunity this business offers. The fact that this business has attracted to it such business men as former bankers, executives of businesses—men who demand only the highest type of opportunity and income—gives a fairly good picture of the kind of business this is. Our door is open, however, to the young man looking for the right field in which to make his start and develop his future.

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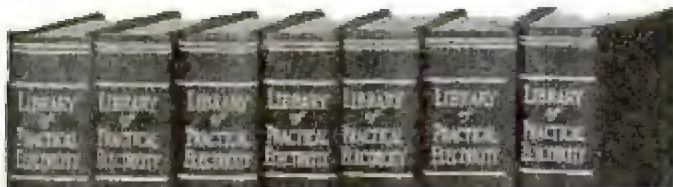
In trying this business out, you can measure the possibilities and not be out a dollar. If you are looking for a business that is not overworked—a business that is just coming into its own—on the upgrade, instead of the downgrade—a business that offers the buyer relief from a burdensome, but unavoidable expense—a business that has a prospect practically in every office, store, or factory into which you can set foot—regardless of size—that is a necessity but does not have any price cutting to contend with as other necessities do—that because you control the sales in exclusive territory is your own business—that pays more on your individual sales than many men make in a week and sometimes in a month's time—if such a business looks as if it is worth investigating, get in touch with us at once for the rights in your territory—don't delay—because the chances are that if you do wait, someone else will have written to us in the meantime—and if it turns out that you were the better man—we'd both be sorry. So for convenience, use the coupon below—but send it right away—or wire if you wish. But do it now. Address

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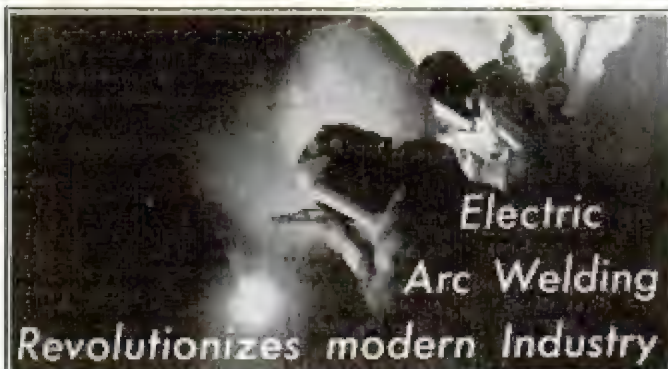
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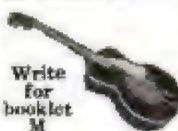


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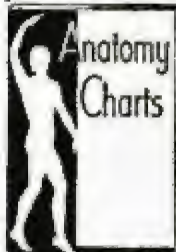
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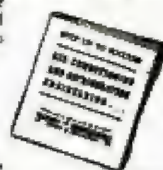
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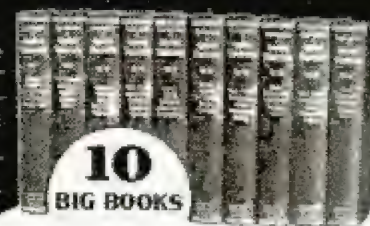
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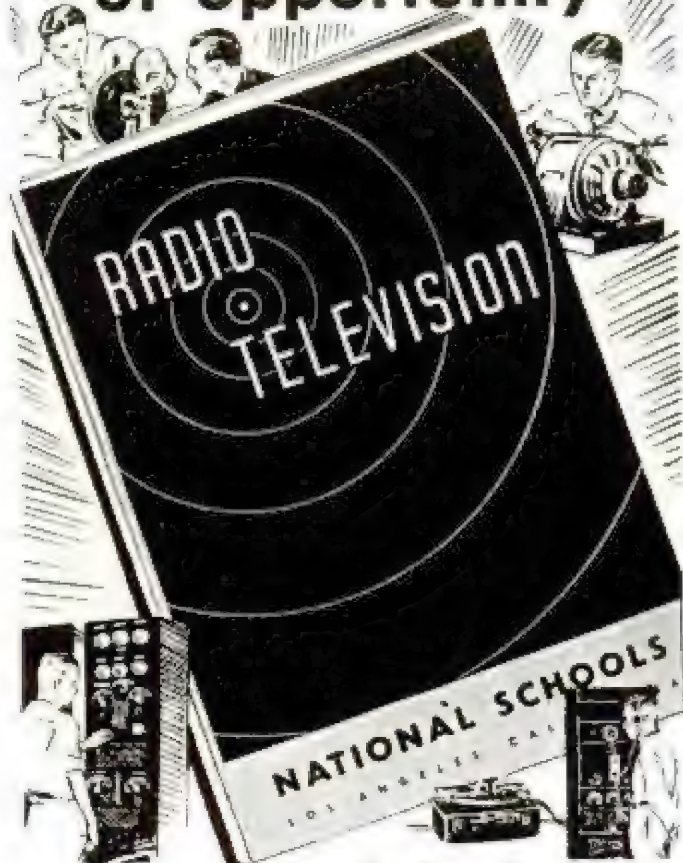
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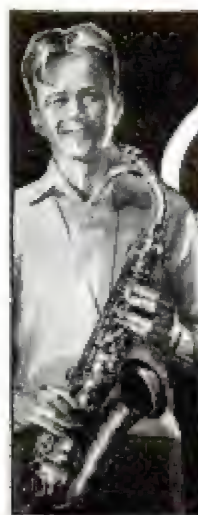
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STOP Squealing, start crowing! No canvassing! Work morning only! Afternoons free! Prepare for big surprise! Copyright 1937. National Folios, Station D, Los Angeles.

COMPLETE Chemical service. Newest guaranteed formulas. Research analyses. Valuable literature free. Special low prices. Miller, Chemist, 1706-J, Tampa, Fla.

LEATHER Neckties. Big profits for salesmen. Look finer than silk. Cleaned with damp cloth. Always look new. All styles, colors. Sample tie and sales outfit 50c. Nu-Mode Ties, 1337-B N. Twelfth, Milwaukee, Wis.

CHRISTMAS Cards. Quick cash profits. Sell 1937's master creations in personal cards and stationery. 7 double value boxes assorted cards. New low prices. Experience unnecessary. Samples free. Wallace Brown, 225 Fifth Ave., Dept. 410, New York.

IF You agree to demonstrate I'll send you free a big stock of actual samples food products, home accessories, etc., and show you how to earn up to \$3 in an hour. Blair, Dept. 381-P, Lynchburg, Va.

OVER 100% Profit selling glove and muffler, tie and handkerchief, hose and tie sets. Many other novelties. Write for catalog of 42 money makers and free sample swatches. Boulevard Cravats, 22 W. 21st St., Dept. M-78, New York.

GENUINE Remington portable typewriter for 10c a day! Men wanted to take orders for this remarkable bargain. M. N. Rand, Remington Rand, Inc., 315 Fourth Ave., Dept. L-50B, New York.

PROVEN Stain remover. Progressive hand cleaner. Sample 30c. No stamps. Milbirt Co., East Braintree, Mass.

BIG, Steady weekly profits for men and women with cut price food route. More than 300 fast selling household and farm necessities. Sensational premium deals get quick cash and build profitable routes quickly. Write Blecker, 259 E. 4th St., St. Paul, Minn.

\$200 A MONTH! Only 10 \$1 sales daily pays \$50 a week. An auto product. Thermo-P Works, Peoria, Ill.

NORTH American oil burners. No experience needed. Free particulars. Wrenn Oil Burner Service, Nashua, N. H.

SENSATIONAL Profit maker! Marvelous discovery electroplates with small brush—easy as painting. Does same beautiful, permanent electroplating—gold, silver, nickel, cadmium, etc.—as big tank outfits. No liquids. Weighs 1 pound. Anyone can use anywhere from dry cells, battery or household current. Big profits selling jewelers, repair shops, etc. Retail 55.75 complete. Details, sample free. Rapid, 854 N. Clark, Dept. AA, Chicago.

AUTHORIZING Exclusive representations revolutionary faucet water softener. Luxeau, Sausalito, Calif.

PROFIT With new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists. BD-1142 Sunnyside, Chicago.

SELL Herb teas, health books, cosmetics. Box 2095, Hollywood, Calif.

CALLING All agents! Million ideas for new numbers to sell! "Agents Buying Guide"—lists and describes unusual novelties and specialties; also staples at lower prices, from all over the world! Free particulars. Glass Pub. Co., Ellwood City, Penna.

100% PROFIT Through making own products. Established 1919, customers in 54 countries. Catalog 532 opportunities free. Grinstead, 505 Fifth Ave., New York.

SELL Comic Christmas seals. Sensational! Different! Sample set 10c. Rogge, Grayslake, Ill.

A SALES Winner. Write John L. Schaffner, Greenwald's, Allentown, Penna.

YOU Can make money. Sell Glas-Glo. Fast mover. Wonderful repeater. Big profits. Many home and garage uses. Sample (enough for 100 windows, windshields) 3 cents. Glas-Glo Co., Dept. 117, Phelps, N. Y.

"KET" Cleans everything, pays 100%. Jaxons, 809 N. Luzerne, Baltimore, Md.

ATLAS For window sign letters. See our display ad, page 44A.

BIG Profits. Sell "delightfully convenient" California souvenirs. Request sample. DeFrees, 1042 W. 90th St., Los Angeles, Calif.

MEXICAN Hand-made feathered Christmas cards, gifts. Unusual, different; tremendous profits. Free particulars. Samples 10c stamps. Marquez, Apartado 1176-F, Mexico City.

CHRISTMAS Cards earn \$2 an hour. Take orders galore from friends. 50 exquisite folders with name at \$1. Free album 20 designs. Fastest selling 21 folder box in America. Costs 50c. Sells \$1. Request samples. Sunshine Art, Dept. E, 154 Nassau, New York.

KNOCK-OUT 25c Seller, sample 10c. Reynolds, Conroy Bldg., Casper, Wyo.

NATIONAL Wholesale buying guide. Lowest prices from everywhere. 50c. Middleton Co., Box 694, Muncie, Ind.

SANTA Claus talks like phonograph. Speaks your greeting. New. Mysterious. Send \$1 for six. Talkie Toy Co., 4451 Irving Park, Chicago.

DISTRIBUTOR, Most liberal proposition ever offered, repeating sales. Graco, Bx144, Port Huron, Mich.

JO BO Rubber bow ties. Excellent sideline. Jo Bo Products Co., 3402 School St., Des Moines, Iowa.

51 CHRISTMAS Card assortments. Cost only 33c. Contains 25 folders. Write Champion Greetings, Box 696, Atlanta, Ga.

CHRISTMAS Cards—50 beautiful folders, name imprinted, cost 55c, sell for \$1. Marvelous 21-folder assortments sell for 60c and \$1, pay you 100% profit. Samples free. Rush inquiry; get started quick! New England Art Publishers, North Abington, 256, Mass.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 149 Fifth Ave., New York.

QUICK Cash profits selling perfumed Xmas cards. Perfume novelties. Particulars free. Sample 10c. Mission Co., 2328W Pico, Los Angeles, Calif.

SUCCEED With your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

DISTRIBUTORS—Supply revolutionary corn remedy to stores. New plan results in landslide of orders. 150% profit. Exclusive franchise. Reliable Specialty Corp., Buffalo, N. Y.

BIG Money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50, make \$1.45. Ten orders daily easy. Write for particulars and free sample. American Monogram Co., Dept. 40, Dunellen, N. J.

AGENTS: Smash go prices. Santos coffee 12c lb., 4-oz. vanilla 8 1/2c. Razor blades 10 for 8 1/2c. 100 sticks chewing gum 12c. Christmas cards, 21 in box, 14c. 150 other bargains. Premiums. Experience unnecessary. Carnation Co., P.O. St. Louis, Mo.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1950 W. Broad, Richmond, Va.

AGENTS—Opportunity to make money: book containing 107 successful business plans; home or office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

BIG Money applying gold initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for name plates and tire cover transfers. "Ralco," 1305 Washington, Boston, Mass.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

WANTED—District purchasing agents. No experience or money required. Write Purchasing Manager, 174 N. Halsted, Chicago.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

BIG Money taking orders: shirts, ties, hosiery, underwear, raincoats, dresses, etc. Sales kit free! Experience unnecessary. Write Nimrod, Dept. 3, 4922-28 Lincoln Ave., Chicago.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 1107-P Broadway, New York.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits, Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

HIGH-GRADE SALESMEN

MAN Wanted—by shoe manufacturer established 34 years, for sales work. Ready cash daily and free shoes as bonuses to producers. No experience needed. Your own shoes at factory prices. Complete line showing 250 styles including famous Velvet-Eez air-cushion nailless insole shoes, sent free. Write Mason Shoe Mfg. Co., Dept. D6, Chippewa Falls, Wis.

EARN Big cash daily. Sell shirts with sensational Firm-Edge collars. Always neat and comfortable. Ties, hose, underwear also. All guaranteed one year. Biggest selection; cash commissions daily. Cash bonuses regularly. Sales outfit free. Write, Dept. P-11, Rosecliff-Quaker, 1239 Broadway, New York.

AMAZING Invention closes all doors silently, automatically. New oil principle. Easily installed. Never needs attention. Priced dollars less than other checks. Unlimited market stores, offices, factories. Free demonstrator furnished workers. Kant-Slam, Dept. Y-62, Bloomfield, Ind.

SALESMAN Wanted, \$250 weekly profits made selling special tool set to garages. No competition. Write Mesco, Box 205P, Beaver City, Nebr.

BIG Commissions selling stores celluloid pricing tickets, metal shelf moulding, menu covers, signs, chrome changeable letters. P. Pricing Press, 124 White St., New York.

MEN With cars to sell new electric arc welder to mechanics, repairmen, factories. Wholesale \$2.50. Five minute demonstration makes sales. Up to 150% profit. Trindl Products, 2225-BK Calumet, Chicago.

500% PROFIT! Gold reflecting letters for store windows. Large sizes 1c. Free samples. Modernistic Sign, B-5004 Lincoln Ave., Chicago.

NATIONALLY Known calendar-novelty manufacturer wants experienced salesmen for new framed Glasscraft mirrors. Biggest seller in years. Ad-Nov-Co., Newton, Iowa.

GIVE Away free 1937 short wave and home radios, also full electric automobile radios with our unique "Punch Sales Card Plan." 2 sales daily pays \$203.88 weekly profits. Write for our free starting offers. DeLuxe Mfg. Co., Dept. 334, 173 W. Madison, Chicago.

IF You are ambitious you can make good money with a Rawleigh route. We help you get started. No capital or experience needed. Steady work for right man. Write Rawleigh's, Dept. K-2-PPM, Freeport, Ill.

NEW Punchboard assortments. Free large colored catalog. Nothing to carry. Larger cash commissions daily. Season now! Addwill Sales Co., 180 Adams, Chicago.

WANTED—Men for good paying work with a large shoe company. Good pay every day. Free shoes as bonuses to "go-getters." No experience needed. Complete sales outfit sent free. Write Consolidated Shoe System, Dept. M7, Chippewa Falls, Wis.

SALESMEN—35% Commission paid daily. Take orders for every day business necessities and advertising specialties from service stations, restaurants, hotels, garages, taverns, offices, etc. Lowest prices. Free deals and premiums. Free outfit. Willens, 2130 Gladys, Dept. VN, Chicago.

SENSATIONAL New invention. Sells on sight to garages, gas stations, through simple demonstration. 3 sales daily earn \$91.50 weekly. Write Salesmanager, A2417 N. Ashland, Chicago.

SWEETEST 25c Seller out! Gold embossing ink, decorate Christmas cards, etc. Sample 12c. Hundreds other items, catalog free. Premiums, M-12, Gaylord, Minn.

SALESMEN. Distributors, new deal, more profit. Exclusive territory. 125 varieties brushes, mops, specialties. Newway Brush Co., Hartford, Conn.

LIFETIME Opportunities. National Salesmen's Bureau, Cutler Bldg., Rochester, N. Y.

TRADE Stimulator. \$10 deal. 50% commission. Particulars free. Scruggs Photo Service, 104 Elmwood, Chattanooga, Tenn.

AFTERNOONS Free for outdoors, movies, \$350 month, home! Unique plans. No canvassing! Expect surprise! Copyright 1937. National Folios, Sta. D, Los Angeles.

NEW. Sells instantly every business. Unlimited field. Very profitable. Rush name. Rimer, Silver Springs, N. Y.

NEW Sales stimulator. Gas stations, stores. Advance cash. Automatic repeats. Sales kit free. Standard, 524 S. Spring, Los Angeles.

REMINGTON Rand will employ local representatives for portable typewriter division. No experience or investment. Unusual opportunity for reliable man. Write M. N. Rand, 315 Fourth Ave., Dept. L-50A, New York.

SELL Nothing. \$95 weekly. \$500,000 punchboard firm announces new, no investment plan. Season starting. K&S, Dept. C1211, 6227 Broadway, Chicago.

TOOL Salesmen; sell new inexpensive electrical trouble shooter. Every repairman buys on demonstration. Many making \$75 weekly as side line. Factory, 2812 Gilham, Kansas City, Mo.

GOOD, Constant, repeat profits, selling complete line American manufactured electric incandescent lamps, including specialties. Necessity for home, office, factory, store, farm. Branching out nationally after selling largest reputable concerns for years. Guaranteed product. Kulp Lamps, 700 S. Clinton St., Chicago, Ill.

ADVERTISING Book match factory offers you amazing opp. We are largest in world selling direct. Big cash comm., bonuses. Full—part time, big repeats. Samples and kit free. Match Corp. of America, Dept. E-11, 6041 Grand, Chicago.

PROTECTED Territory Beeman's Airvac for cleaning cars, \$7.85. Superior to electric vacuums regardless price. Beeman Co., Denver, Colo.

SALESMEN. Sell calendars, complete line, all sizes, including jumbos; beautiful subjects. Samples free! Flemming Calendar Co., 6543 Cottage Grove, Chicago.

DISTRIBUTORS! Up to 300% profit. Strange new Gauztape Bandage. Wonderful demonstrator. Unlimited market. Exclusive territory. Write! Modern Necessities, A-737 Randolph, Chicago.

PRINTING Salesmen: Include our line. Universal, 727 Central, St. Paul, Minn.

SALESMEN Representing national manufacturer selling salesbooks, tickets, restaurant checks, to theatres, restaurants, stores, buses, hotels, clubs. Liberal commission. Elliott Ticket Co., 400 Lafayette St., New York City.

MAKE More money with Red Comet Automatic Fire Extinguishers. Low price. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 704 Red Comet Bldg., Littleton, Colo.

NOTHING To sell. Be my local buyer! I furnish the money. See page 153A.

TIRE Accessories. Guaranteed 10,000 mile Tiger Grip Tire Patch, and complete fast-selling line auto accessories. Salesmen-distributors easily make up to \$75 weekly, and over. Protected territory. Economy Rubber Products Co., 830 Burkhardt, Dayton, Ohio.

IMAGINE Going into stores, gas stations, etc., empty-handed and coming out with money in your pocket. New, powerful progressive sales stimulator. Merchants going for it. Fast, advance cash commission getter. Automatically repeats. Sales outfit free. Meinhardt, Dept. B-7, 18 E. Kinzie, Chicago.

BE Your own boss. Make the largest commissions selling our complete line of brushes. Write for sales plan. Wire Grip Sanitary Brush Corp, 220 Southern Blvd., New York.

BRUSH Salesman—If you ever sold brushes write for our money making proposition. Donald Brush Co., Camden, N. J.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Ferrell cleared over \$1,000 monthly. Write, F. E. Armstrong, President, Dept. PM, Mobile, Ala.

FREE Booklet describes 107 plans for making \$20-\$100 weekly, in home or office, business of your own. Elite Co., 214 Grand St., New York.

SPARKLING Glo-Brite signs sell fast to stores, restaurants, taverns. Lasting gold finish. Plenty profit. J. A. Baxter, Cambridge, Ohio.

BIG Money taking orders: shirts, ties, hosiery, underwear, raincoats, dresses, etc. Sales kit free! Experience unnecessary. Write Nimrod, Dept. 63, 4922-28 Lincoln Ave., Chicago.

HELP WANTED

STOP Job-hunting. Be your own boss. Start profitable mail order business of your own. No selling. Write Hant Service, 516-W Federal, Pittsburgh, Penna.

MAN And wife, to run local coffee agency. Earnings up to \$240 in a month. New Ford sedan given you as bonus. I send complete outfit. You don't risk a penny. Details free. Albert Mills, 2460 Monmouth, Cincinnati, Ohio.

USE \$500? Raise canaries for us. Splendid sparetime money maker, fascinating work. We supply singers and buy back. Write for free particulars. Crimmins, Box 44B, Woodside, N. Y.

EDUCATIONAL AND INSTRUCTION

AIR Conditioning, electric refrigeration industries demand trained men for installation, service, maintenance and sales. Qualify in 3 months. Free employment service. Established 34 years. Get new book "Step Up to Success" free. Write O. Werwath, President, 1020-J N. Broadway, Milwaukee, Wis.

LEARN Fascinating profitable profession of Swedish massage in great resident school in Chicago. Short course. Write for free illustrations of massage technique. Low tuition. The College of Swedish Massage, 1601 Warren Blvd., Dept. C1, Chicago, Ill.

DEGREES Earned by home study in arts, sciences, philosophy, education, psychology, theology, law, chemistry, engineering, business, agriculture. McKinley-Roosevelt College, Chicago.

BE A radio expert—Many make \$30, \$50, \$75 a week. Learn at home in spare time. Radio's big growth making many good full time and spare time jobs. Write for free copy of 64-page book. National Radio Institute, Dept. TMPA, Washington, D. C.

LEARN Morse Code. New method brings voice of teacher and live messages into your own home. Complete practical course with album of records, text and electric key set—\$15. Send for circular PM. Linguaphone Institute, Rockefeller Center, N.Y. 10020.

KNOCK-EM-COLD! Learn police Jiu Jitsu! 36 secret knockout blows without fists, many one-fingered, headlock breaks, etc. New complete illustrated course by world-famous instructor, only 15c today. S. J. Jorgensen, Maritime Bldg., Seattle, Wash.

GET Pay raise. "7 Hour" Home Bookkeeping Course. Complete. Guaranteed satisfaction. Send \$1. Shelby System, Dept. 3, P. O. Box 621, Memphis, Tenn.

BECOME An investigator—Secret service agent. New "Test Problem Method." Develops your ability. Particulars free. International Secret Service Institute, (PM117), Hoboken, N. J.

WORK For "Uncle Sam." Start \$1260-\$2100 year. Prepare now. Full particulars telling how to get appointment, free. Franklin Institute, Dept. J3, Rochester, N. Y.

MECHANICAL. Electrical, chemical engineering; Spanish, political science. Boyle, Kellogg St., Clinton, N. Y.

500,000 USED Technical and business books. Sold, rented, exchanged. All subjects. Satisfaction guaranteed. Cash paid for used books. Complete details and illustrated bargain catalog free. Send name. Nelson Co., 4014 Manhattan Bldg., Chicago.

HIGHER Arithmetic solves problems quickly. Frederick A. Smith, 2410 Bernard St., Chicago.

TAKIGRAPHIC-SHORTHAND Complete \$1. Folder-lesson dime. Satisfaction guaranteed. Simmons, Rocky Hill, Conn.

MILWAUKEE Industries desire to contact earnest men to learn electric arc welding in their laboratories of the School of Engineering. Moderate training fee. For details write President Werwath, 1020-K N. Broadway, Milwaukee, Wis.

EARN Extra money! Clipping and preparing newspaper articles for publishers. Simple; fascinating; profitable. Send stamp. Division 55A, National Press, 3923 W. Sixth, Los Angeles, Calif.

MEN Wanted willing to learn landscape designing and fill big paying position as landscape architects. Free test of your natural ability and chance to win in \$750 contest. No experience needed to start. Earn while you learn. Write today for free test blank. American Landscape School, 837 Plymouth Bldg., Des Moines, Iowa.

SECRET Investigations. Excellent opportunity. Particulars free. Write George Wagner, M-2640 Broadway, New York.

BIG Bargain catalogue educational matter 10c. Handling, Y-799 Broadway, New York.

SHORTHAND Brings opportunities. Catalogue mailed. Shorthand Institute, 6330 Clayton, St. Louis.

LEARN Machinist trade, tool, die making. Automatic and hand screw machines. Modern shop methods. Actual work. Jobs open for trained men. Employment help. Illustrated booklet free. Allied Screw Machine Co., 601 Lake St., Chicago.

GET \$50 To \$87.50 every pay day on Uncle Sam's payroll. Many appointments expected soon. Our coaching helps qualify you for Social Security, liquor gauger, meat inspector, office clerk, stenographer, typist, customs, postal and many other positions. Write today for free book, list of positions, etc. Patterson School, (Arthur R. Patterson, former Government examiner, Principal), 8 Case Bldg., Rochester, N. Y.

MAKE More money. Get a U. S. government job. Get our new plan for obtaining one—no obligation. Age 18-50. Write Instruction Service, 101, St. Louis, Mo., immediately.

BECOME Business investigator. Make money in your spare time. Pleasant work, good fees. Details free. Business Detective System, 1009 Oak, Elmira, N. Y.

BLUEPRINT Reading taught by mail. Write Blueprint Reading Institute, Box 5662, Metropolitan Sta., Los Angeles.

LEARN Auto mechanics, body, repairing, welding, electricity, refrigeration, Diesel. Stevenson's, 2008A Main, Kansas City, Mo.

MASSAGE. Hydrotherapy, dietetics, drugless therapeutics, chiropody, taught by mail. Evans Correspondence School, Montgomery, Ala.

PLAYS—STORIES—MANUSCRIPTS

MARKETING. Advisory service for writers. Free bulletin 5A. Don Wimmer, Route 7, Huntington, Ind.

WANTED. Original poems, songs, for immediate consideration. Send poems to Columbian Music Publishers, Ltd., Dept. 209, Toronto, Can.

SHORT Stories revised, typewritten, marketed. Details free. Hursh Service, Box P-1013, Harrisburg, Penna.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

STUDY Commercial and applied arts by mail. Practical, inexpensive courses. New methods, easy to learn. Illustrated booklet, terms, for stamp. Enkeboll Art Academy, Omaha, Nebr.

NEW Complete spiral bound book of instructions on cartooning and lettering with paper, pens, pencils, brushes, prepaid \$1. Cardinell Corp., Montclair, N. J., Dept. 1.

CARTOONING Course: 30 illustrated lessons, with over 500 drawings, pens and pencils. \$1 complete, postpaid. Scovell Studios, Box 748-P, Hollywood, Calif.

AMATEUR Artists Magazine publishes your drawings. Prizes. Sample copy, information, 20c (coin). Art Reproduction Service, 126 Lexington Ave., New York.

SILK Screen process. See our ad under Printing Outfits. Artset Co.

FREE! Make rapid-fire sketches of pretty girls! It's easy, with "Stencil-Art" charts. No obligation, just send stamp. "Stencil-Art," Brookhaven, Ga.

EARN cash income, copying and duplicating simple cartoons for advertisers. 3-M Service, Argyle, Wis.

ADVERTISING AGENCIES—FOR ADVERTISERS

LEARN Advertising quickly at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 3001 Michigan Ave., Dept. 3431, Chicago.

ANY Sales letter written for \$2. Komaroff, 532 Pine, Long Beach, Calif.

33 WORDS, 25 Magazines, \$2. Goodall Agency, 742 Market, San Francisco.

ADVERTISE Profitably: \$15 reaches 8,000,000 Sunday newspaper readers with 24 word ad. Newspaper, magazine, rate-guide, free. Chicago Union Agency, 20 W. Jackson, Chicago.

FREE—New Advertisers Rate Guide, 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, 140 S. Dearborn, Chicago.

ADVERTISING Placed anywhere. Helpful, free service. Rate guide book free. Baker Advertising Agency, 189 W. Madison, Chicago. Successors to Ankrum Advertising Agency. Established 27 years.

ADVERTISE: 5 Lines 100 national mail order publications \$4. Lists free. Advertising Bureau, 4515-C Cottage Grove, Chicago.

INCH Display advertisement 30 magazines year \$24. Wood's Popular Services, Atlantic City, (N. J.)

BUSINESS SERVICE

BETTER Sales letters for any product. Hutzler Advertising, 324B Neal, Dayton, Ohio.

MANUFACTURER'S Addresses, any line, 25 for \$1. 40,000 listed. Nation's Service, 35 N. Ninth, Columbus, Ohio.

INFORMATION—Where to buy anything! Manufacturers, wholesalers addresses. 25c (coin). King Co., Box 141, Columbia, Penna.

WASHINGTON, D. C., mail address. For business or personal purposes. \$2 monthly. Hawkins Mail Service, 817 Fourteenth.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

SIMPLEX Typewriters \$3, American Flyers \$3.50, Remingtons \$12, Coronas, portables \$20, check writers \$7, electric motors \$7. Catalog 10c, credited. Demo, 114 Ford, Providence, R. I.

UNDERWOOD No. 5 typewriters \$29.50. Reconditioned unredeemed pledges. Pawnbrokers Exchange, 1218 7th, Washington, D. C.

PRINT Your circulars, bulletins, etc., in attractive colors with the Vari-Color duplicator, \$29.75 complete. Single color duplicators \$4.95 and up. Illuminoscopes (great aid for preparing stencils), \$4.95. Vari-Color Duplicator Co., Dept. X, Ottumwa, Iowa.

NEW \$3.75 Automatic adding machine. Fully guaranteed. Bassett, Box 302D, Alhambra, Calif.

TYPEWRITERS. Duplicators, multi-graphs. Write for free list office machine bargains. Save half. Pruitt, 518 Pruitt Bldg., Chicago.

INCREASE Business now. "Excelsograph" Rotary Stencil Printer reprints thousands everything you typewrite, hand-write, draw or trace. Colors, \$19.75 to \$44. Terms. Illustrated literature free to business or professional men. Pittsburgh Typewriter Supply, Department K-2, Pittsburgh, Penna.

RUBBER STAMPS AND OFFICE SUPPLIES

TWO Lines 25c; three 35c. Stamp Works, 6004-E S. Talman, Chicago.

CUSHION Mounted, one-two lines 25c, three 35c; facsimile signatures \$1.50. Stamp Works, 814 Bradley, Peoria, Ill.

NAME Address, 2 lines 25c; 3 lines 35c. Stamp Works, Auburn, Nebr.

2 LINES 25c, 3 Lines 35c. Stamp Works, Centerport, N. Y.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

LEADER Quality—250 business letterheads and envelopes, \$2. Cards, labels, statements reasonable. Mimeographing service. Thomas Wood, Massena, N. Y.

150 EACH, 8 1/2x11 Letterheads and envelopes \$1. Benneville, 907 W. Roosevelt, Philadelphia.

500 ENVELOPES \$1; 1000 Cards \$1. Springer Print, Miami, Okla.

BOND Letterheads, 500, \$1.39; dime for samples. Ranney, Sheldon, N. Dak.

PHOTO Engravings—Zinc line cuts made, 10 square inches, \$1 up; halftones; electro; artist; speedy; free price list. Rite-way Engraving, 1467P Broadway, New York.

EXCEPTIONAL Value. 20 exquisite Xmas folders. Steel die engraved etchings. Your name printed, \$1 postpaid. Universal Greetings, Orange, Mass.

500 LETTERHEADS And 500 envelopes, \$3.25, postpaid. Webpress, Farmland, Ind.

ATTENTION, Businessmen everywhere! Advertise with Sanderson's book matches. Big public demand. Low cost, modern, practical. Printed to order: 1,000 books \$4.50, 2,500, \$8.95. Sanderson's Book Matches, Ottawa, Ill. (Salesmen wanted.)

FREE Pricelist! Mimeographing! Printing! Popular prices! Sylco, Downers Grove, Ill.

250 LETTERHEADS, Envelopes, \$2.25. Pricelist. Moffett Printing Co., Bloomfield, Ind.

POSTAGE Saving letter heads, ten dollars thousand. Electron Prints, New Orleans, La.

SAMPLES—Large portfolio free. Attractive prices! Sanderson's Printing, Ottawa, Ill.

1000 CIRCULARS, 6x9, \$2.75. Business cards \$1. United Printing, Pottstown, Penna.

500 BOND Letterheads, 8 1/2x11, \$1.75; 250 letterheads \$1; 250 envelopes \$1; 250 statements \$1, prepaid. Samples stamp. Perry Printer, Lafayette, Ind.

MIMEOGRAPHING: 1000 \$2.85 Postpaid. Samples. Cop-Y-Cat, P. O. Box 840, Milwaukee, Wis.

FINE Printing, reasonable. 250 two color letterheads \$1.95, postpaid. Samples. Crestwood, 2704 E. 18th St., Kansas City, Mo.

BUSINESS Cards, 70c 1000. The Card Co., 750 E. Ninth, Los Angeles, Calif.

BETTER Grade printing, reasonable priced. Free samples. Economic Press, Leona, N. J.

LABEL Specializers. Better values. Free samples. 6618H Quimby, Cleveland, Ohio.

6x9 CIRCULARS. Letterheads, statements, envelopes, \$2.95, 1000. Economy Press, Oconto, Wis.

1000 LETTERHEADS, Billheads \$1.75. Victors Press, Exeter, N. H.

PERSONAL Quality stationery; premiums; samples. Grenn, 105 W. 58th, New York.

PRINTING—All kinds, quality work. Low prices. Samples free. Michaels Press, Box 103-c, Station W, Brooklyn, N. Y.

LABELS: All kinds. Write, samples. JESCO, Box 93, Holyoke, Mass.

500 3/4x2 1/4 **FOUR** Line gummed stickers, 25c. Moritz Printery, Saginaw, Mich.

QUALITY Printing. Lowest prices. Samples. Tucker Press, Box 63, Indianapolis.

PRINTING OUTFITS AND SUPPLIES

PRINT Your own cards, stationery, circulars, advertising. Save money. Easy rules furnished. Print for others, big profits. Junior outfit \$8.85; job presses \$11. Details free. Kelsey Co., B-11, Meriden, Conn.

HAND Press, type and complete printers' supplies. Advise equipment you need and we quote prices; or send stamp for catalog. P. Pfeiffer, 24-B; 6 Columbia St., Newark, N. J.

6x9 **PRESS**, \$5. Bargain lists 3c. Novelty Shop, Downsville, La.

NEW Type 25c font. Catalog dime. National Type Co., Jackson, Mich.

HAND Presses, type, supplies. Send stamp for catalogue. Printers Sales, 114 S. Howard St., Baltimore, Md.

HAND Presses, new type, supplies. Lists 3c. Landis, Richland, Penna.

SILK Screen process. For showcards, signs, displays, etc. Decorating toys, furniture, novelties. On paper, cardboard, wood, metal, other products. Easily learned. Complete instruction. Particulars free. Artset Co., 637 Case Bldg., Rochester, N. Y.

BARGAINS, Presses, type, List 3c. Exchange D-15, 22 Orient, Meriden, Conn.

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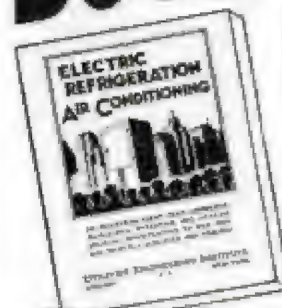
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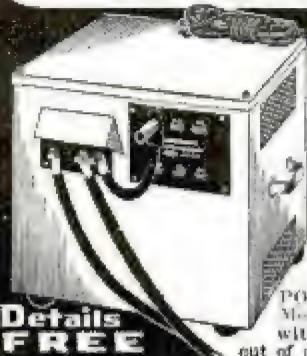
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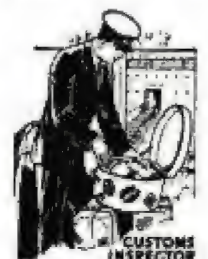
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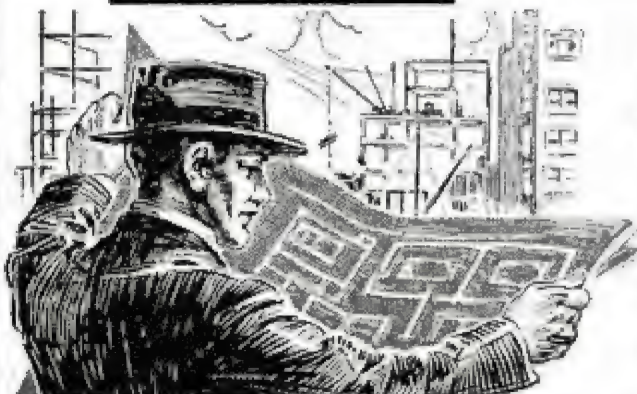
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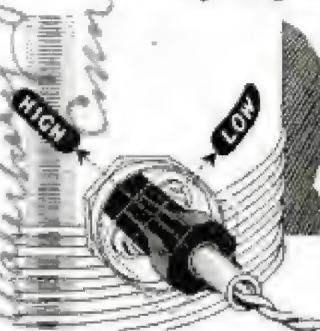
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NEW INVENTIONS

(Continued from page 38A)

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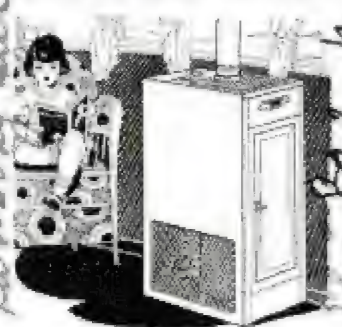


with a double element. Plugging the electrical connector into the socket in one position produces heat sufficient to cook food in Pyrex dishes. Plugging in

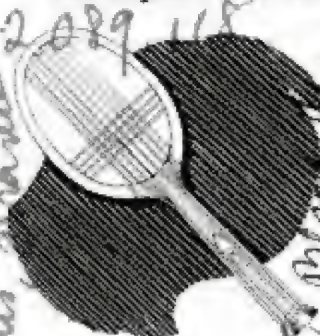
the connector in another position keeps the food hot, between 160 and 180 degrees, but does not allow overcooking.

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INSTEAD of taking the tennis racket to an expert workman to get the strings



tightened, players soon may be able to buy a racket with built-in string tightener. A new patent provides for extension of the strings into the handle in which there is

built a means of increasing the tension of both vertical and horizontal strings.

SHELLS made of plastic may replace the metal now used for bombs and bullets, as the result of a recent patent. The plastic employed is obtained by condensing urea and formaldehyde, which are cheap and plentiful, and it may be molded readily. Being lighter in weight, the plastic shell bullets could be carried in greater

(Continued to page 70A)

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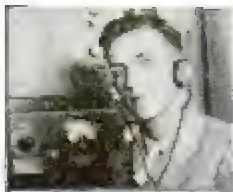
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Ralph William Ben,
Chief Engineer, KOKO,
Lafayette, Colorado.

The fact that I graduated from a nationally recognized school, First National Television, proved most essential in obtaining my splendid position as First Engineer at KLPB — which I secured a few days after graduation.

William A. Bell,
First Engineer, KLPB,
Minot, North Dakota.



My FNT training and actual experience on your stations KXBY and W9XAL made me the first man selected when WSAY went on the air. We just employed another First National graduate.

Thuclo A. Greene,
Engineer, WSAY,
Rochester, N. Y.



Graduating from FNT I obtained a service shop position without losing a single day. Experience at your Station, KXBY, while training, and my license enabled me to obtain my present position on the WHP engineering staff.

Nathan W. Aram,
Operator, WHP,
Rock Island, Ill.



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A few days after graduating, I received your telegram advising of a vacancy here. I applied, was hired, and began work that same day. My qualifications as a graduate of FNT and the valuable experience gained while training, got me the job!

Leland E. Nelson,
Operator, WTAD,
Quincy, Illinois.



I have been at KGGM for over two years, coming here from KFEI. I have seen other fellows come and go, but I have stayed on, thanks to the training and practical experience I received from FNT.

R. G. Leonard,
KGGM, Operator,
Albuquerque, N. M.



I have been able to get and hold this job with considerable success because of the reputation FNT has for turning out first class radio engineers. It provides the greatest amount of practical laboratory work. I like the work fine.

S. L. Spencer,
Operator, KBIX,
Muskegon, Okla.



I got my position at this 5000-watt station soon after finishing training. First National's reputation for turning out men who really know radio proved a big factor in getting this job.

Alvin W. J. Wessel,
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William Greene,
Operator, WMAZ,
Macon, Ga.



Specialized knowledge of Sound engineering gained through First National training lead to my becoming manager of this theater. I also do considerable projector work for other theaters.

Marshall Hooks,
Mgr., Texas Theater,
Trop., Texas.



I was employed at WNOX the day after I graduated from First National. The training and experience I received enabled me to handle work for our new studio layout, and building our new 5000-watt transmitter.

J. Gilmore Shaeffer,
Operator, WNOX,
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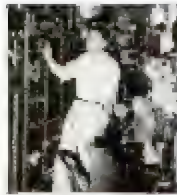
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D. W. Bataillon,
Jr. Engineer, WGRB,
New Albany, Ind.



My training at FNT gave me the education necessary to secure my first class license — and a fine position at KGFX. I am happy to know so many of my classmates are making good in a big way.

Robert H. Dye,
Chief Eng., KGFX,
Pierre, South Dakota.



My job as chief recording engineer in our program transcription studios was only made possible by complete, advanced training received at FNT. I heartily recommend First National training.

William E. Brennan,
Chief Recording Eng.,
R. C. Comer Adv. Co.,
Kansas City, Mo.



Several weeks after completing First National training, I look over the duties as Chief Engineer. Thanks to the actual experience secured through FNT's radio and television stations, and the service record on my license, I was hired without question.

J. D. Miller,
Chief Engineer, KBTM,
Jonesboro, Arkansas.

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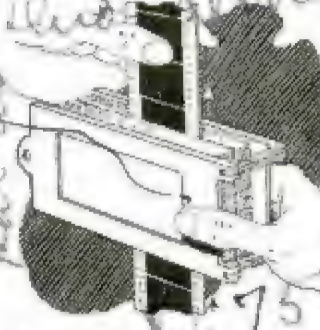
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NEW INVENTIONS

(Continued from page 64A)

quantities by soldiers. The inventors claim that the resin shells do not corrode and stick together, as do brass shells when clamped side by side in firing clips.

AMATEUR and professional photographers will find a new hinged sponge pack of invaluable assistance in the darkroom. Surface moisture can be removed from both sides of the film at the same time with one hand and flat photographic paper can be dried quickly and easily.



RAINY weather will no longer be accompanied by clogged salt shakers if housewives adopt a new type. The secret of the latest shaker is a tip made of diatomaceous earth which absorbs moisture. Then, when it rains, the tip keeps the salt running



freely instead of clogging the holes of the attractively designed shaker.

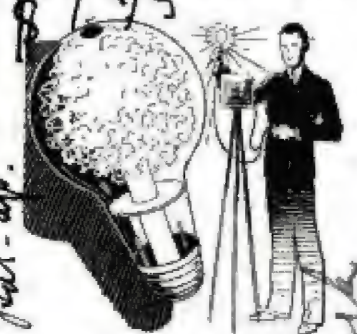
MORE comfort in trains, airplanes and buses is the purpose of a headrest which is adjustable to the wearer. It consists of a light frame of two semi-circular members pivoted together at their ends, with springs to keep the two sections apart and with a chain for adjusting them. A strap attached to the frame secures it to the neck of the wearer.



FOR controlling the pitch and roll of ships with oil-burning engines, a recently patented invention provides for double bottom and wing tanks to be built in the sides of each vessel. In these is

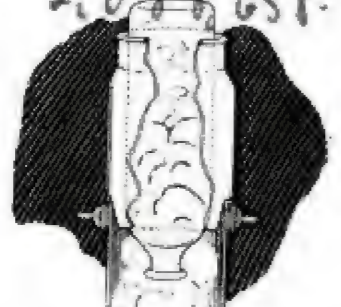
stored the oil used by the engines. These tanks are divided into long cells by iron partitions, with valves in the partitions controlled from a central station. Opening and closing the valves controls the flow of oil from one cell to another. When the ship begins to roll, the valves distribute the flow of oil so it acts as a counterweight to the roll.

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DIALING a number on the telephone may be made easier by a small arm designed to engage the holes in the dialing plate. Recently patented, the equipment works on a ball and socket, with the arm extending from the ball. Releasing the pressure of fingers on the dialing arm permits it to withdraw from the dialing plate after each letter or number is dialed.

DESIGNED for improved sterilization of baby's bottle, a nursery utensil has just been patented. It consists of a sterilizer into which the bottle is placed, top down. Arrangement is made for steam to be blown into, and around the mouth of, the bottle, completely cleaning it. The bottle fits closely in the utensil, preventing steam from escaping out the top.



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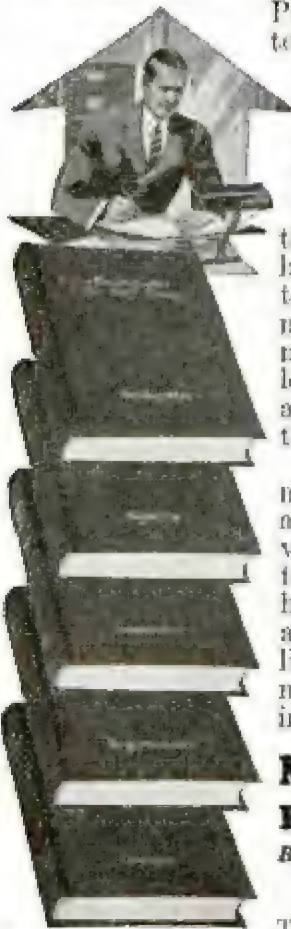
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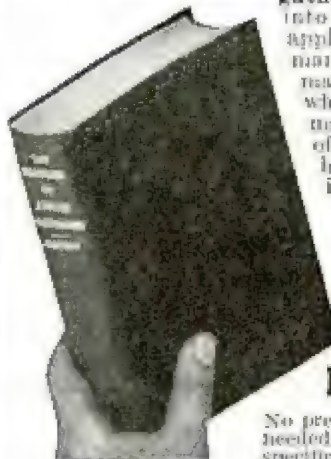
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Vol. 68

NOVEMBER, 1937

No. 5

PIGEONS *delayed* *by* RADIO WAVES

TRANSMITTER WORKING
AVERAGE TIME 50 MINUTES

TRANSMITTER NOT WORKING
AVERAGE TIME 20 MINUTES

CIRCLING 20 MIN.

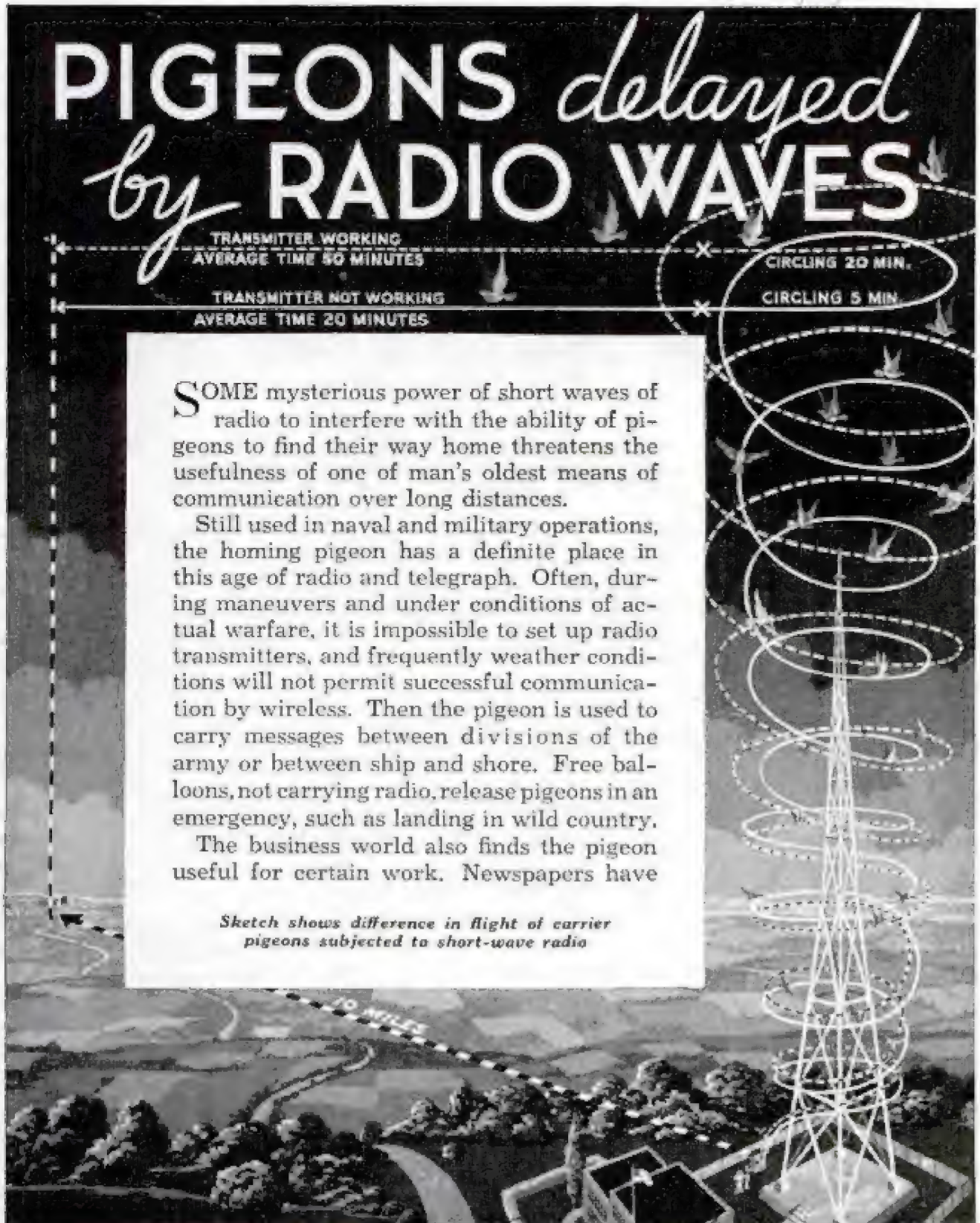
CIRCLING 5 MIN.

SOME mysterious power of short waves of radio to interfere with the ability of pigeons to find their way home threatens the usefulness of one of man's oldest means of communication over long distances.

Still used in naval and military operations, the homing pigeon has a definite place in this age of radio and telegraph. Often, during maneuvers and under conditions of actual warfare, it is impossible to set up radio transmitters, and frequently weather conditions will not permit successful communication by wireless. Then the pigeon is used to carry messages between divisions of the army or between ship and shore. Free balloons, not carrying radio, release pigeons in an emergency, such as landing in wild country.

The business world also finds the pigeon useful for certain work. Newspapers have

Sketch shows difference in flight of carrier pigeons subjected to short-wave radio



Cont. George Eckhardt.
2047 N. Park Ave.



Official U. S. Navy photograph

found the birds an aid to coverage of stories in isolated places, reporters sending their copy and photographers their film to the main office in small capsules attached to pigeons' legs. One publication recently instituted pigeon communication service for transmission of news from its rural correspondents, finding it faster than the mails and less expensive than wire service.

Scientists long have been baffled by the ability of the pigeon to find its way home under the most adverse conditions of weather and warfare. This ability cannot be attributed entirely to inherited instinct, since a long period of training is necessary, no matter how fine the breeding of a bird. The training is largely a matter of food for the pigeon. While the birds are young, they are taken farther and farther from the home loft, without being permitted to satisfy their hunger, and they return for food.

It has been found that neither fog, storm, smoke nor the noise and fumes of bombardment have any effect on the carrier pigeon's ability to return home. A pigeon will fly 300 miles a day easily and some are capable of 600 miles. Strangely enough, the average pigeon will not fly at night, but will interrupt its journey to roost, re-

Some of the pigeons used in U. S. Navy's test of radio's effect on the birds' ability to find way home

suming flight again at daybreak. In the World War, there was recorded the feat of a pigeon that flew twenty-five miles in twenty-five minutes, returning with its message even though badly wounded. In floods in the west, it was found that for two days pigeons found their way safely while weather and atmospheric conditions prohibited operation of radio. The birds seem able to find their way home over a radius of as high as 1,000 miles and hitherto nothing seemed to affect their unerring sense of direction, a sense that science has not explained.

But just recently, tests conducted by Lieut. George F. Watson, in charge of the U. S. Navy's loft at Lakehurst, N. J., indicate that radio's short waves have a very definite effect on the pigeons' sense of direction. Ordinarily a carrier pigeon, upon being released, rises in spirals to gain altitude, then takes off in the direction of its home loft. In the presence of radio waves transmitted on six megacycles, however, the pigeons have extreme difficulty in finding their way, and instead of going off in a

(Continued to page 158A)

Dummies Fight Back in Football Scrimmage

Mechanical dummies that resist like a fighting lineman are training football players on college fields this fall. One dummy, in appearance much like the traditional type, is held in place by a double piece of airplane shock cord at the top and another anchoring it to the ground. It yields only

Evansston, Ill.



Top, airplane shock cord anchors dummy at top and bottom and it snaps back against blocking player. Left, robot dressed like player is used for scrimmage practice; it "fights back" from elastic anchorage. Bottom, dummy with interfering arms, supported by metal brace

slightly to the blocking or tackling player and then snaps back, forcing him to drive hard and dig in with cleats. Dressed like a player, with arms and legs, is another robot trainer that can be set in any defensive position, crouched, standing or charging. It offers heavy resistance, is mounted on three rollers and a metal arm, and is designed for practicing body and cross blocks as well as tackling. A third dummy is also built like a man, its arms interfering with the player, its legs and head kept in place by airplane cord. This robot is used for team dummy scrimmage. When the player charges, the elastic cord gives the effect of the defense man fighting back.

Moonlight Has No Effect on Growing Plants

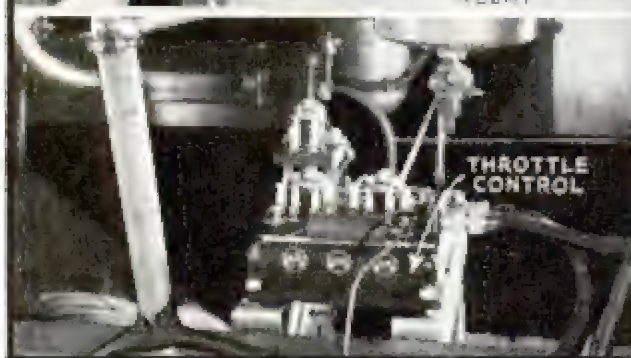
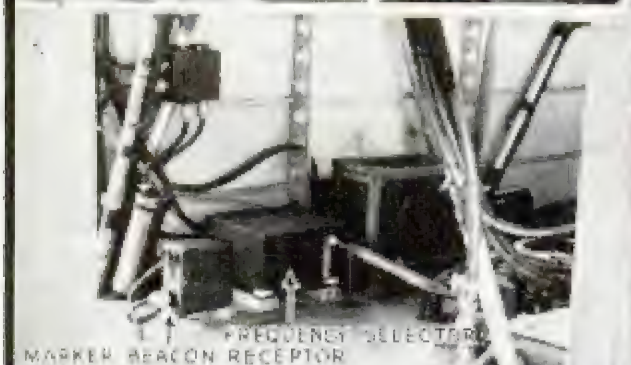
If "artificial moonlight" can be taken as a criterion, moonlight has no effect on the growth of plants. The sun's light reflected from the moon has a high proportion of polarized light, so for experimental purposes oat seedlings were exposed to polarized light—light whose wave fronts vibrate in only one direction. Plants usually bend toward light and need light to assimilate carbon dioxide and form carbohydrates. Under artificial moonlight there was no evidence that plants reacted in either way, or that polarized light had any effect.

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ROBOT Lands



COMpletely automatic landings, once only a dream of the aviation industry, have become a reality. While the pilot merely keeps an eye on instrument settings to insure their accuracy, electro-mechanical equipment within the plane responds to different radio wave lengths, each flashing from a portable station on the ground, in such a manner as to bring the ship gliding smoothly to earth at the airport.

At no time does the pilot touch hand or foot to the controls. From the moment he closes the automatic landing switch a few miles from the airport until the plane stops on the ground, its motor idling and its brakes applied, his only function is that of a monitor, watching instruments and seeing that they operate properly. His also is the role of safety man, because he is ready at any moment to make a readjustment of settings or to take over the controls in an emergency.

With the coming of automatic landing, aviation authorities now look forward to the time when passenger liners will be flying from coast to coast, making scheduled stops en route, with a robot performing every function except that of taking off. And the automatic takeoff may result from experiments now being considered.

Equipment developed by the U. S. army air corps makes possible the robot landing. In repeated test landings at Wright Field, Dayton, O., every mental and manual procedure required in a conventional landing has been duplicated unerringly by four ground radio stations and the apparatus within the experimental plane.

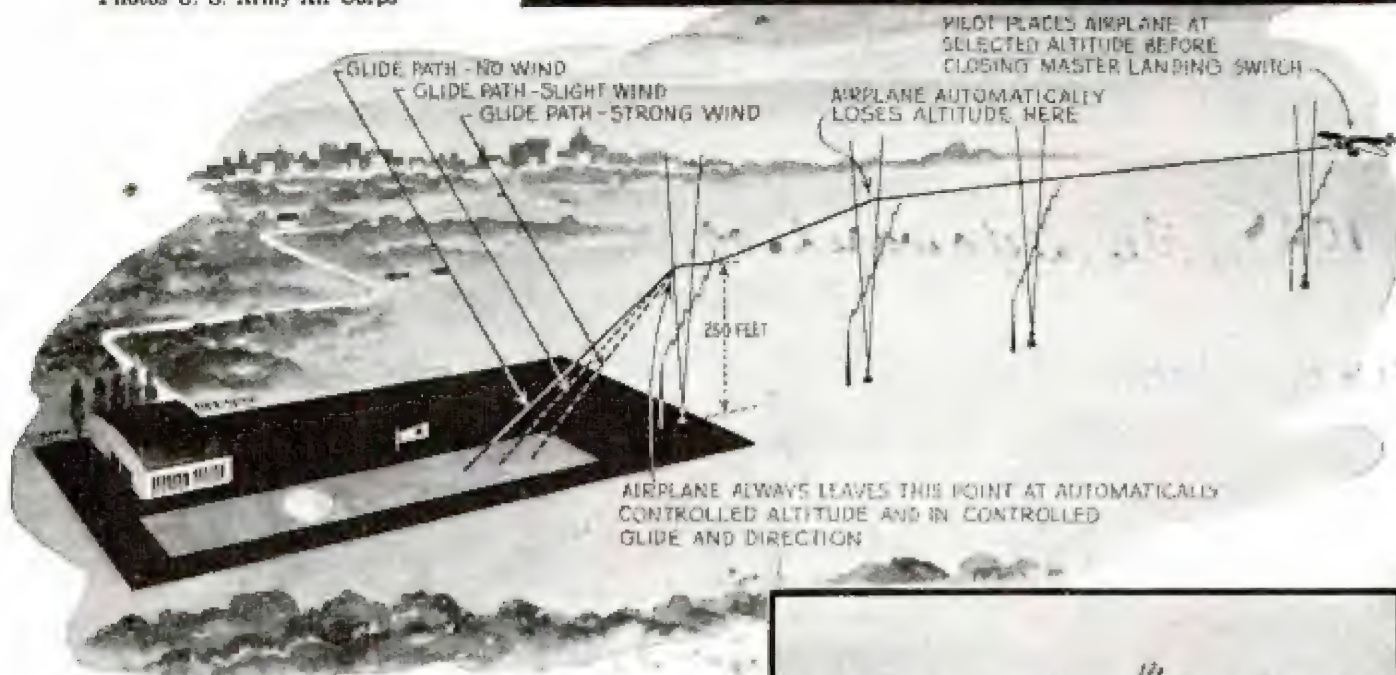
In making a landing, the pilot simply flies the craft in the usual manner to within range of a portable radio transmitter located about eight miles from the landing field, and closes the automatic landing switch. The army radio compass thus is tuned automatically to the wave length of the station, 365 kilocycles. The radio compass is coordinated with the gyro pilot, or

Five photos at left show essential parts of the electromechanical equipment which enables plane to land automatically. Note master switch, in photo at top, which pilot throws when ready to land

PLANE without Human Aid

Top, inventors of the landing device standing beside experimental ship. Left to right, Capt. Carl J. Crane, Capt. G. V. Holloman and Raymond Stout, project engineer. Center, diagrammatic explanation of plane's path as robot brings it to earth. Bottom, truck containing radio beacon transmitter is shown with antenna set up for flashing guiding signals to plane. Portability of the transmitters makes it possible to guide planes into the airport from any direction, simply by shifting the trucks

Photos U. S. Army Air Corps



automatic pilot, which maintains control over rudder, elevators and ailerons to turn the plane in the precise direction of the ground station.

This coordination between the compass and the gyro pilot was developed by the army over a year ago, and provided the first major step from the army blind landing system to the completely automatic landing. The gyro pilot is standard equip-

(Continued to page 160A)



Big Plane Lifts Small Craft to Start Flight



Top, the composite aircraft, consisting of large plane and smaller ship on top, in flight. Bottom, the "mother" plane landing after a test hop. This arrangement is intended to help heavily loaded planes to start long journeys without the usual takeoff problems



For launching small, heavily loaded aircraft into the air at the start of a long flight, a large "mother" plane is being used in experimental takeoffs to lift the small ship. Then, at the proper altitude, the small plane casts off from its position atop the mother ship and continues alone, the larger plane returning to its base. In test flights at Rochester, England, recently, a giant flying boat took the role of mother ship, with a small, speedy plane serving as the other principal in the

"sister" act. The composite aircraft was conceived as a means of solving the problem of getting planes into the air with heavy loads. Frequently the pilots of planes scheduled to make long-distance flights have been unable to lift their ships due to the heavy load of gasoline.

Clock Turns on Radio and Light at Any Hour Desired

Simple to operate and inexpensive, a new style clock is designed to do many things automatically. It will turn on the radio and a light at the hour desired by the owner. Or it may be used to control defrosting of the refrigerator and to turn on the mechanism for chilling the box again before the family arises. Air-conditioning units may be switched on, with the aid of the clock, before



tenants reach offices and shops, and many types of electrical appliances may be controlled. The clock is set, like any alarm clock, at the hour when the owner desires it to switch on apparatus. It is manually wound and the control mechanism is en-

tirely mechanical, adapting the clock to use with any voltage or cycle of electric current. The clock is plugged into the electric circuit, then the radio and light or other appliance are plugged into outlets in the back of the clock. With the clock set for the hour desired and the radio tuned to the station desired, the control key is turned to "set" position, turning the radio off until the hour when the clock operates to turn it on.

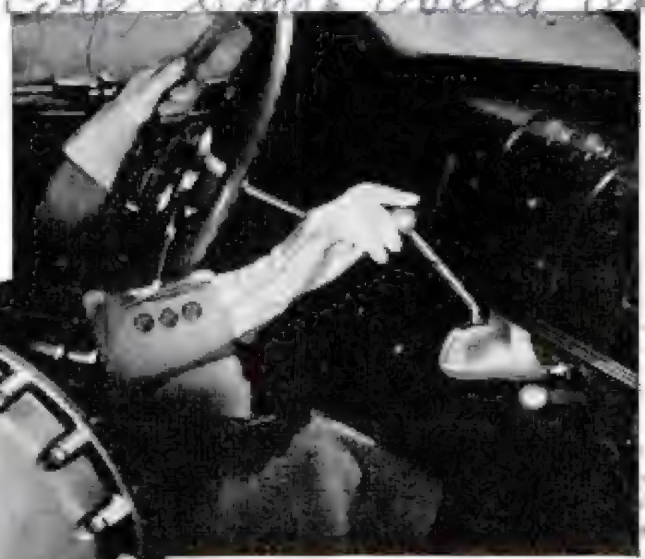
Washing Machine That "Thinks"

After setting two dials on an automatic washing machine which virtually "thinks," you can leave the rest to the washer. One dial selects the proper temperature for washing the particular fabric in the tub. The other times the process, giving the clothes a soaking, starting the agitator, and after finishing the washing it administers three fresh water rinses and then spins the clothes damp-dry.

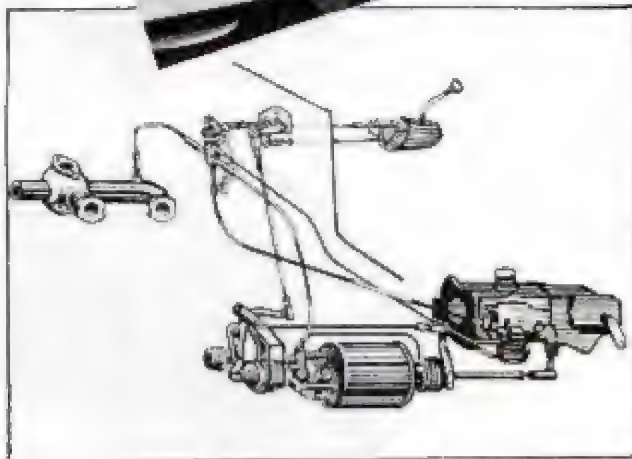
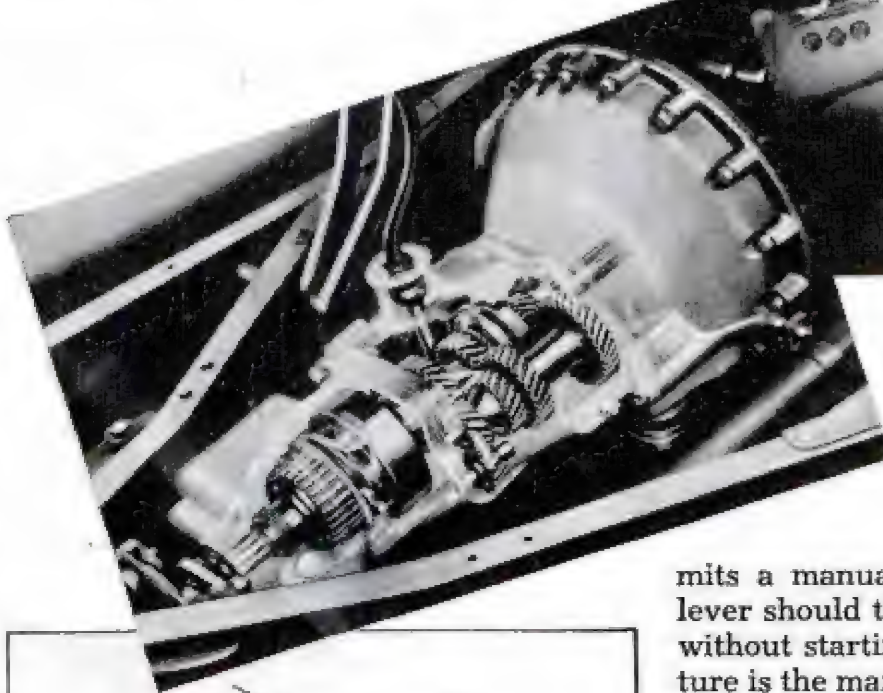
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Vacuum Shift Gives More Space in Latest Cars

Among the features of the 1938 Studebaker is a vacuum transmission control offered as optional equipment. This control utilizes the engine-manifold vacuum to actuate the transmission gear changes. A small shift lever, five inches long and topped by a knob, extends from beneath



Top, vacuum shift lever. Center, transmission shown turned on its side. Bottom, vacuum shift. Shift lever is at top right. Exhaust manifold from which power is derived is at upper left. Vacuum booster is at center bottom, and transmission at bottom right



the instrument panel. This lever shifts the gears. There are no levers extending upward from the floor boards, so the front compartment is completely cleared, adding to the amount of space. Differing from other power-actuated shifting devices in that the gears are under full control of the driver at all times, the shift can be made quickly or slowly. Vacuum control is made possible by a balanced-valve construction which employs a "walking beam" to prevent the vacuum cylinder from working ahead of the control lever. Their movements are simultaneous. The hookup per-

mits a manual gear shift with the same lever should the driver wish to shift gears without starting the engine. Another feature is the manner in which the front compartment has been virtually cleared of the tunnel. Turning the transmission on its side is the secret. For many years the transmission shifting mechanism has been superimposed above the main shaft, which, in turn, has been above the countershaft. By turning it on its side the vertical size of the transmission is reduced three and three-eighths inches, decreasing the height of the tunnel.

Serum for Burns Promises Aid in Fighting After-Effects

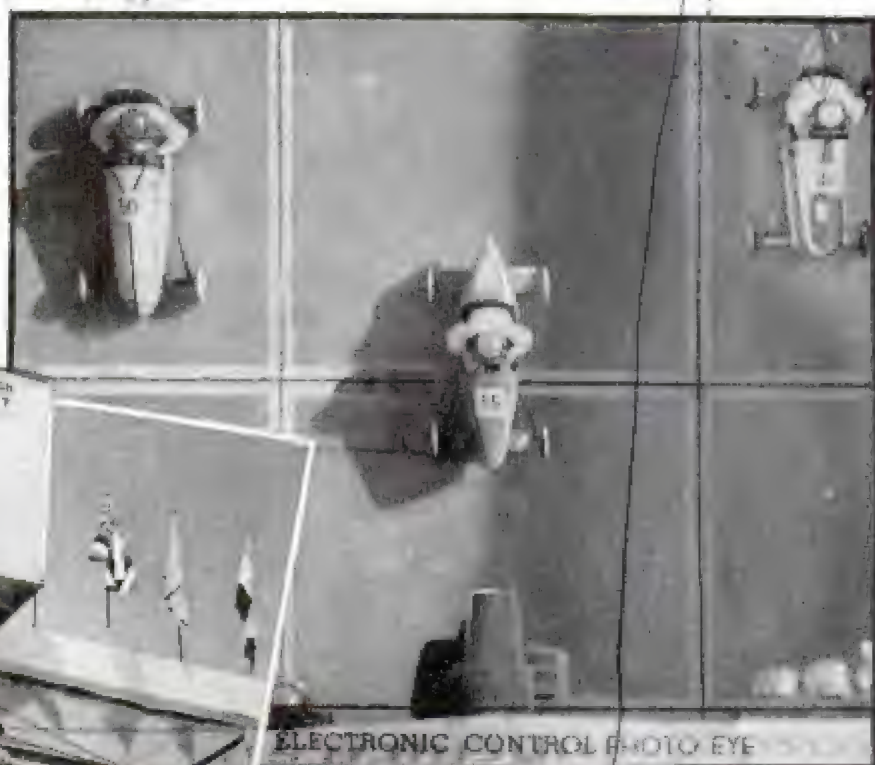
Serum that may save lives and prevent serious after-effects of burns has been discovered by Dr. Sol Roy Rosenthal of the University of Illinois. Besides the local damage to flesh from a burn, severe shock sometimes occurs from the formation of histamine, and sometimes toxic effects after a burn produce ulcers of the stomach. Medical men hitherto have found no satisfactory antidote for these after-effects. The serum is developed from the blood of a person who has recovered from a burn.

Dept. of Therapeutics and Bacteriology.

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Serum and Transm
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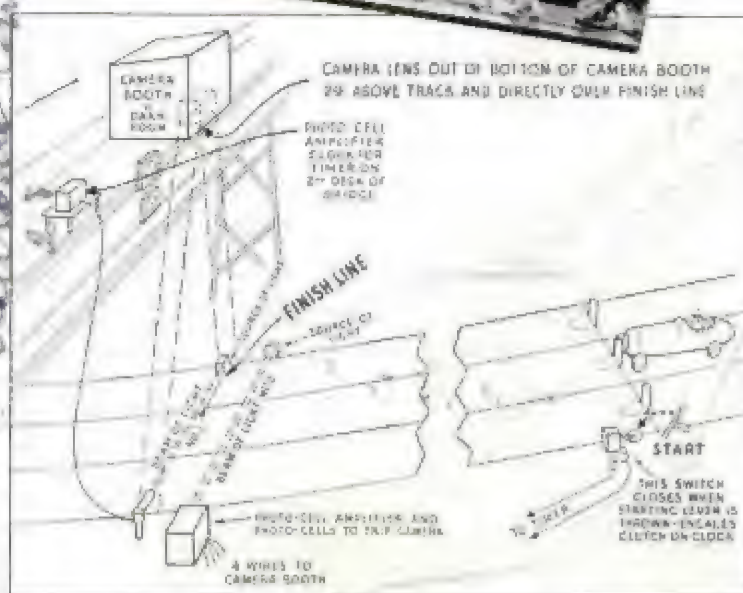
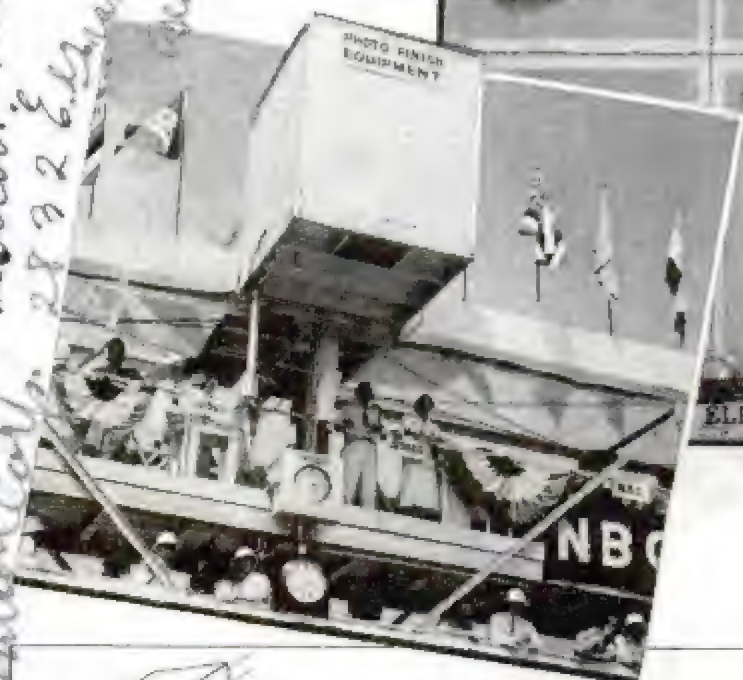
Overhead Camera Snaps Racing Cars at Finish

Use of an overhead camera, actuated by photo-electric cell equipment, to snap racing cars at the finish line, is the latest track practice. Used in the International Soap Box Derby recently, the



Courtesy Chevrolet Motor Co.

Center, overhead camera booth. Bottom, sketch of photo-finish and timing hook-ups. Top, photo of three cars at finish line in the derby



apparatus catches a photograph of the cars from above, instead of from the side as is the case in other kinds of racing. Thus the resulting picture facilitates identification of the winning car and driver. The camera, overhanging the center of the finish line, is focused through an opening about thirty feet above the track. The shutter is operated by an amplified impulse from a

light beam and photocell just in front of the finish line. Exact location of the light beam, the breaking of which sets the apparatus in operation, is determined by painstaking trial, the equipment being mounted a few inches uphill to compensate for the small time-lag between arrival of the car and the click of the camera. Special fast developers in the darkroom, built integral with the camera booth, enabled operators to deliver enlarged prints within two minutes after the conclusion of each heat of the derby. The races were timed by an electric clock, amplifier tubes and relays.

The clock ran continuously, but the hands remained stationary at zero until the switch at the starting line was closed, releasing the small motorless cars for the race downhill. A second impulse, originating as the foremost car broke a beam of light at the finish line, stopped the ticking hands, giving the time. The derby is run on a 1,183-foot concrete hill.

Installed by Ralph A. Pavers
Electronic Control Corp. 2832 E. 12th St.
Cleveland, Ohio

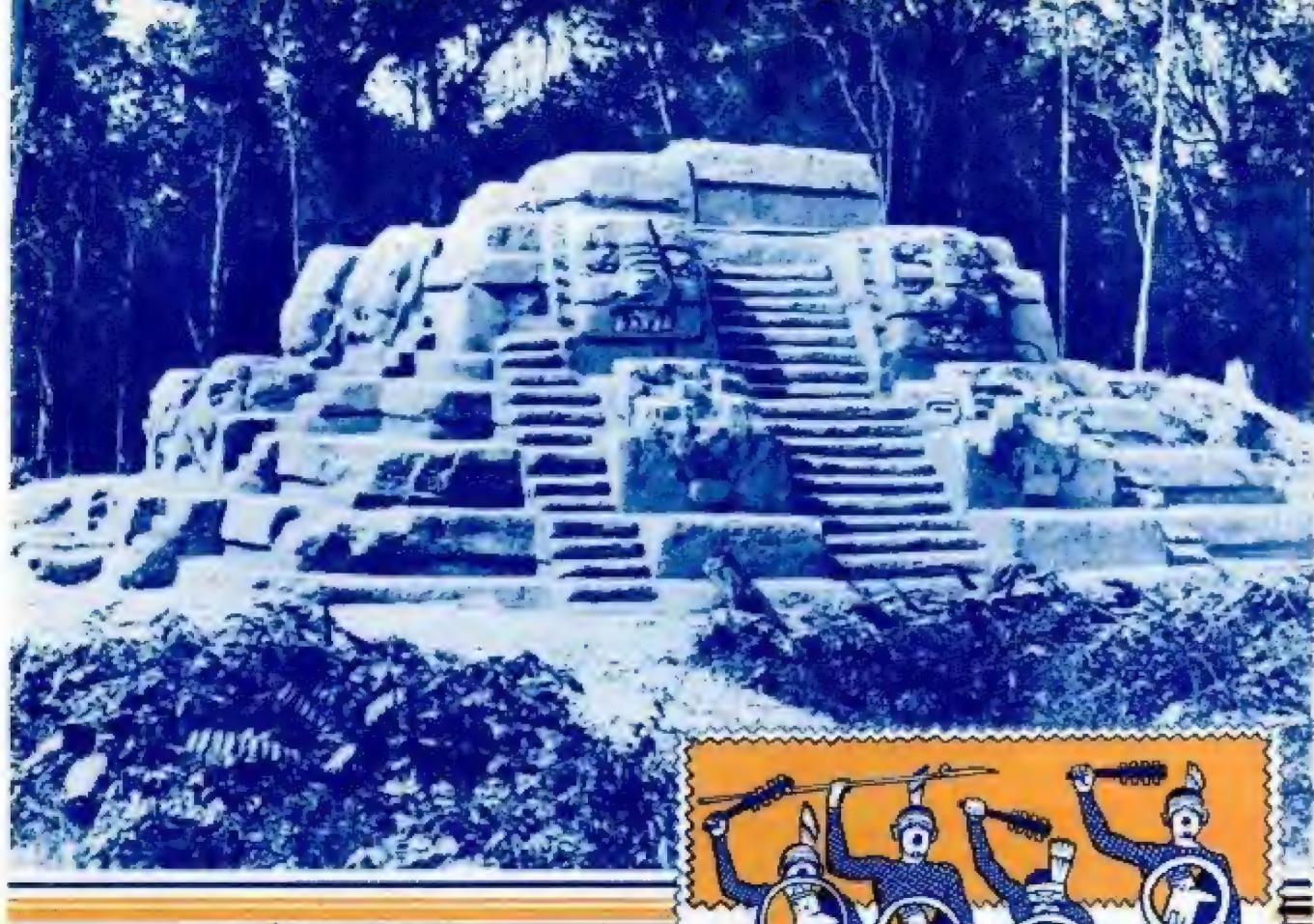
*Carrasco
Museum
Puebla
Mexico*

MOTHER of the gods worshiped by the Aztecs. Her head is formed of two serpent heads. Below, Aztec war god and stone used for human sacrifices.



The WONDERS *of a* LOST EMPIRE

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MAYAN pyramid at Uaxactun in Guatemala. It was built of uncut stone and faced with dazzling white stucco. Flanking the stairs are colossal masks fashioned in the likeness of grotesque human heads.

PART II

BURIED in the dense tropical underbrush of the Yucatan peninsula stand the ruins of the Egypt of America, the crumbling remnants of a hundred "dead cities" erected centuries ago by the Mayas, the most brilliant aboriginal people who ever inhabited this continent.

Some of the great pyramids, temples and palaces contain blocks of limestone weighing fifty tons each. These were cut out of solid rock, transported to the building site, carved with intricate designs and raised up on other blocks to form, perhaps, a part of a towering temple atop a lofty pyramid.

Yet these early Americans had no beasts of burden, no tractors, no wagons or sledges to move the millions of tons of stone which went into the building of their many cities. They had no cranes, no derricks or winches to help lift the blocks and apparently possessed



no knowledge of the wheel, pulley or windlass as we know them.

They built without benefit of metal tools, structural steel, cement, hollow tile, machine-sawed and dressed stone, explosives, compressed air, gas, steam or electricity. With nothing more than their bare hands and a few crude implements of wood and stone they achieved architectural miracles some of which might give pause to modern engineers. How did they do it?

A few years ago no one knew. Today investigators for the Carnegie Institution of Washington and other agencies who have spent years unearthing and restoring the imposing Maya structures are able to supply part of the answer from what they have uncovered. It is unlikely that the question can ever be answered completely.

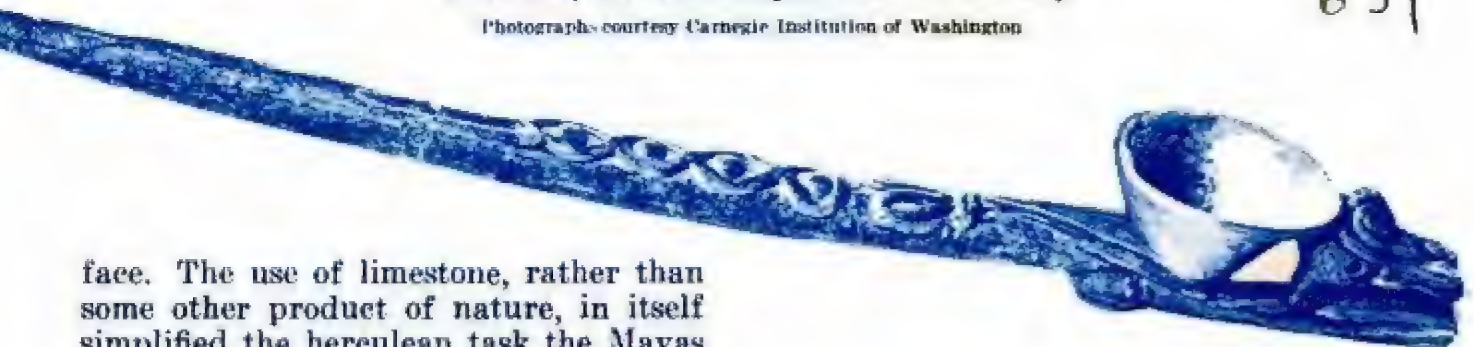
In the first place, Maya building materials were right at hand. The jungle supplied wood and the region of the New Empire was underlaid with a limestone crust only a few inches beneath the sur-



DRAWING of Mayan temple as it appeared when discovered in 1841. Below, three views of the duck's-head pipe, unearthed in front of the Temple of the Warriors. It is twenty-one inches long and made of red clay.

Photographs courtesy Carnegie Institution of Washington

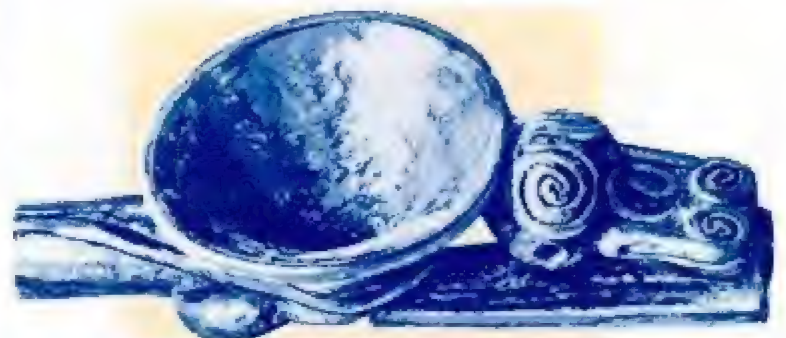
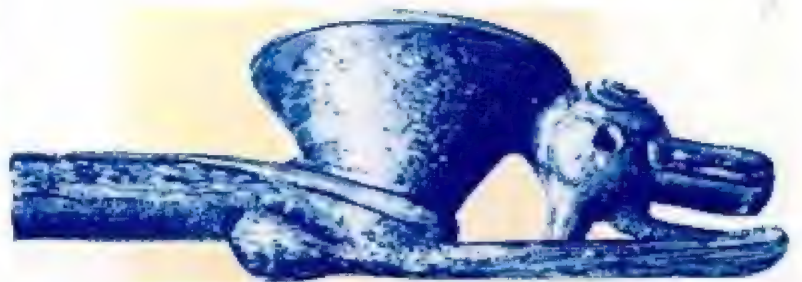
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face. The use of limestone, rather than some other product of nature, in itself simplified the herculean task the Mayas set themselves. This stone, as found in the earth, is quite soft but hardens upon exposure to the air and other elements. So the Mayas had available a material comparatively easy to obtain and shape.

But, even so, the undertaking was no simple one. If you were turned loose in a limestone quarry and given the task of cutting and carving limestone blocks with no other tools than your hands and such implements as you could make with your hands, how would you go about it? That was the problem the Mayas faced.

Archaeologists believe much of their stone cutting was done with the aid of hand hammers or "pecking stones." To fashion such tools, more or less spherical stones harder than limestone were given rough, jagged edges, perhaps by abrasion. Obsidian seems to have been used





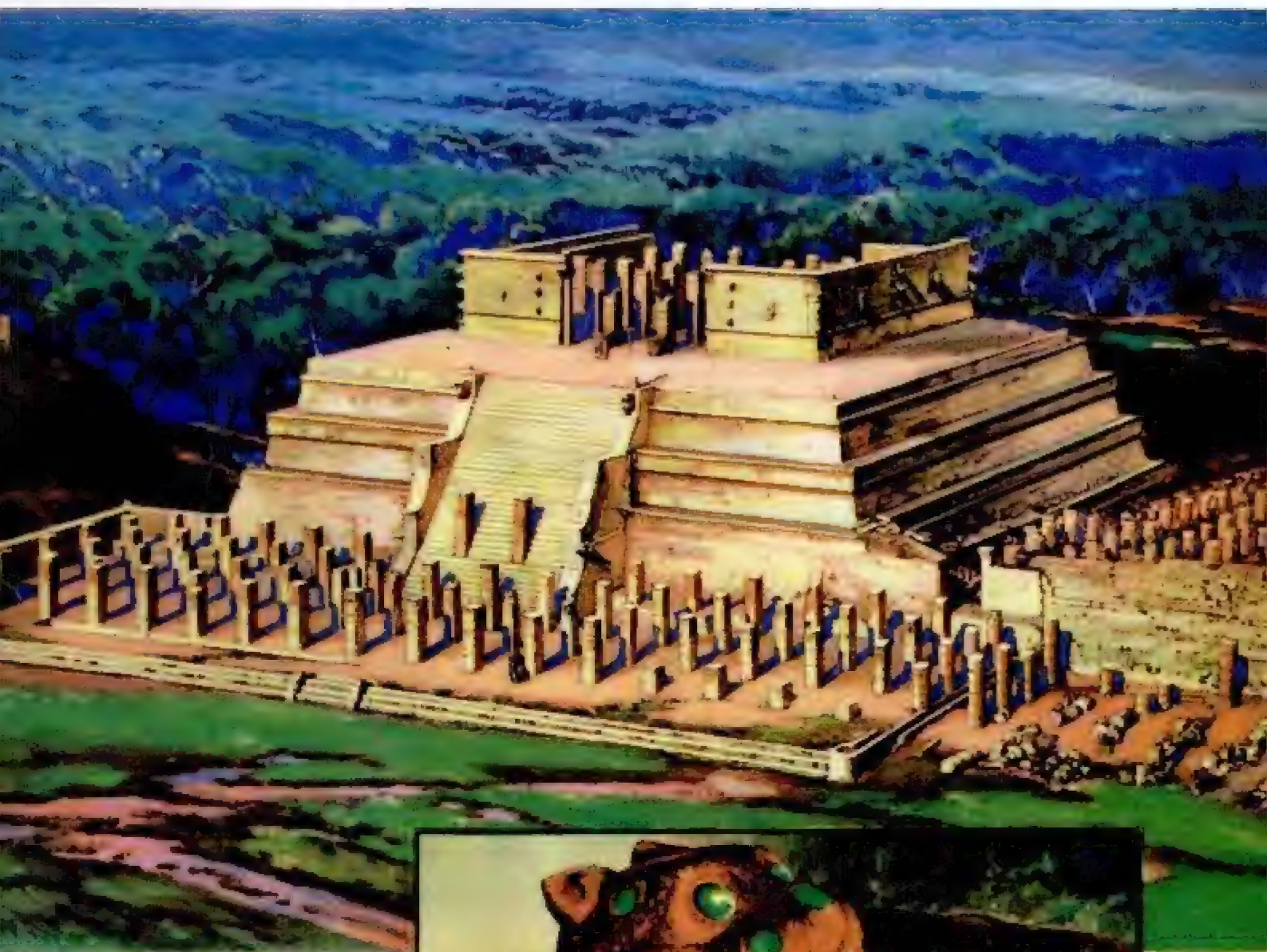
AIR view of ruins of Tulum, ancient Mayan city, surrounded on three sides by a wall enclosing an area of about twenty-two acres.

in making carving tools. By flaking off the outer layers of this substance the Mayas fashioned keen-edged implements like the Indians of a later period made their flint arrow and spear heads. They also employed many wooden tools, using a particular kind of wood which, when charred, becomes very hard and retains an edge or point well.

Strangely enough, there is not as much evidence that stone was sawed as might be supposed. Instead there are indications that column blocks and huge carved pieces like serpents' heads and tails were reduced to the desired dimensions simply by starting with great-irregular rock masses and working on them by tedious abrasion processes. It is difficult to conceive the time required to shape and

carve the thousands of stone blocks by such methods. A Maya stonecutter must have spent a lifetime carving an intricate design with such tools. Patience was indeed a Maya virtue.

Since the Mayas were without beasts of burden and seem to have had no knowledge of the wheel, how did they transport fifty-ton stone blocks and raise them to their appointed positions in a temple wall atop a pyramid? No one can answer this question certainly but it appears likely that they used sections of tree trunks as rollers to move the building blocks along the ground. Raising them into position on a wall was the real problem. This seemingly was done entirely by man power, a formidable task indeed. Some investigators believe that



RESTORED Temple of the Warriors which gives visible proof of the ancient magnificence of the Mayan empire. Right, jaguar throne found in inner chamber of buried temple. It was carved from a single block of stone and painted a vivid red. Spots and eyes are inlays of apple-green jade, while the fangs are of hard white stone. On the back is a mosaic turquoise plaque.



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EL CASTILLO as it appears today, above, and, at left, before restoration. This pyramid is 197 feet square at its base and seventy-nine feet high.

continent was invented by them. Certainly they were master mortar mixers. Their mortar, centuries old, has amazed modern masons by its hardness in view of the fact that the cementing material is only lime. This remarkable quality, says Earl H. Morris, Carnegie Institution archaeologist, is due to two things.

"The mortar was tamped in, probably for hours, until it became as compact as stone," he explains. "Moreover, a special

654 the blocks were rolled and slid into position at the base of a wall, then raised with the aid of woven ropes passed over smooth poles, a rough approximation of a pulley. It seems unlikely that mechanical devices any more complicated were employed, and the sweating backs of hundreds of slaves must have strained to the task of building just one temple by such laborious processes.

The Mayas were probably America's earliest stone masons and some archaeologists believe the art of masonry on this

liquid was used for reworking the surface paste as it was being tamped and finally troweled. The bark of a native tree was stripped off and put to soak in vats. Lime, moistened with the chemical obtained from this bark, takes on a magnificent polish under the trowel and is practically as wearproof as the strongest of the great limestone blocks."

It is doubtful whether the Mayas used any other leveling instrument than the human eye. But they were familiar with the line and plumb bob and employed

A FLAT dish, right, seventeen inches in diameter, from a Mayan burial vault. Below, a section of the frieze carved on the pyramidal foundation of the Temple of the Warriors.



them with uncanny skill. Painstakingly they scooped and scraped mortar with pieces of ground shell and wooden paddles. For finishing plastered surfaces there is evidence that wooden tools were used. By such methods fixing the stone blocks in place must have been almost as laborious a process as pounding and hammering them into shape.

But the Mayas built for the ages. Seemingly, while they used their temples for religious and ceremonial purposes, their main idea was to impress posterity with size, grandeur and magnificence. If such was their plan, they succeeded beyond their fondest hopes. For centuries these structures were assailed by the elements, jungle trees cracked walls and



166
SEACOAST village scene painted on inner wall of Temple of the Warriors and, below, ornamental snake's head carved from solid rock.



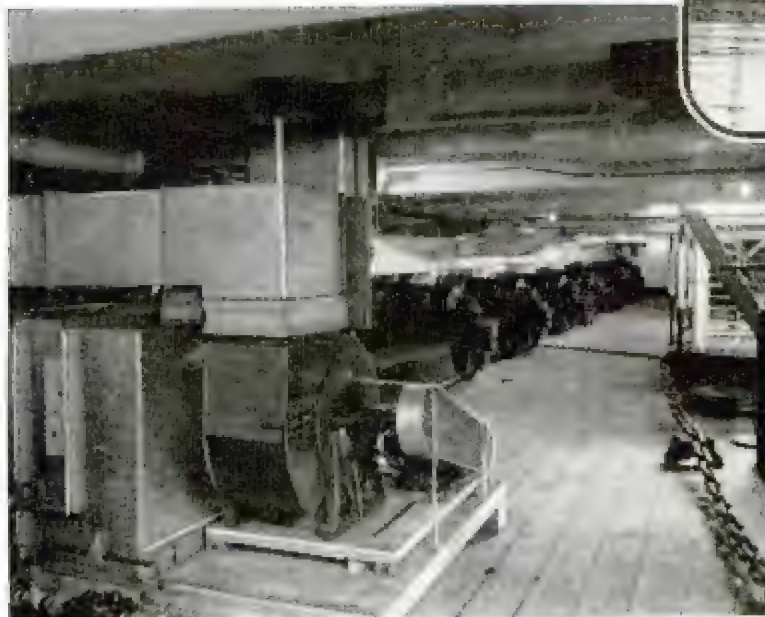
toppled roofs. But, despite the ravages of time, the building materials still endure and archaeologists are able to replace the piles of fallen masonry in their original positions and restore one temple after another.

Since the entire fabric of Maya civilization rested upon agriculture, the religious practices of the people consisted largely of the worship of the personified elements and powers of nature as represented by innumerable gods of the earth and sky. In their efforts to placate the gods of rain, of the soil and of the harvest, they turned for guidance to their priests and the priests, in turn, studied the sun and planets. So it is not remarkable to find astronomical observatories among the finer examples of Maya architecture. The outstanding one was the Caracol at Chichen Itza, the New York City

(Continued to page 128-A)

'Old Ironsides' Air Conditioned to Save Wood

Air conditioning has been installed in the proud old frigate "Constitution" to help preserve her ancient timbers for future generations. The air-conditioning plant is intended for winter use only. Heat is piped into the ship from the Charlestown navy yard during the winter, and the dry hot air has had a tendency to cause shrinkage of the timbers which would damage "Old Ironsides" badly if allowed to continue. So a special installation was designed to meet the requirements of the wooden vessel. Ducts carrying moist air run along the gun deck over the twenty-four-pounder guns on the port broadside, vertically through the main hatch and afterhatch to the berth deck, where they also run along the port side.



"Old Ironsides" in Charlestown navy yard, and air-conditioning plant installed below decks to keep timbers from drying out

Canada Leads in Freight Carried by Airplanes

More freight is carried by air in Canada than in any other nation. Last year commercial air-transport companies in the dominion carried 22,947,105 pounds of freight, chiefly heavy machinery, fuel oil and supplies flown to the remote mining areas of northwest Canada which depend solely on planes for their link with the rest of the world.

Pencil Has Light at Its Point to Aid Writing in Dark

Surrounding the point of the latest pencil is an electric bulb which gives light to facilitate writing in the dark. The light is switched on like a flashlight. A dry battery in the barrel of the pencil supplies current for the light.

Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.



© J. F. Friend

Writing in dark with aid of light at end of this handy mechanical pencil

Export. Japan
Trading Co. 324

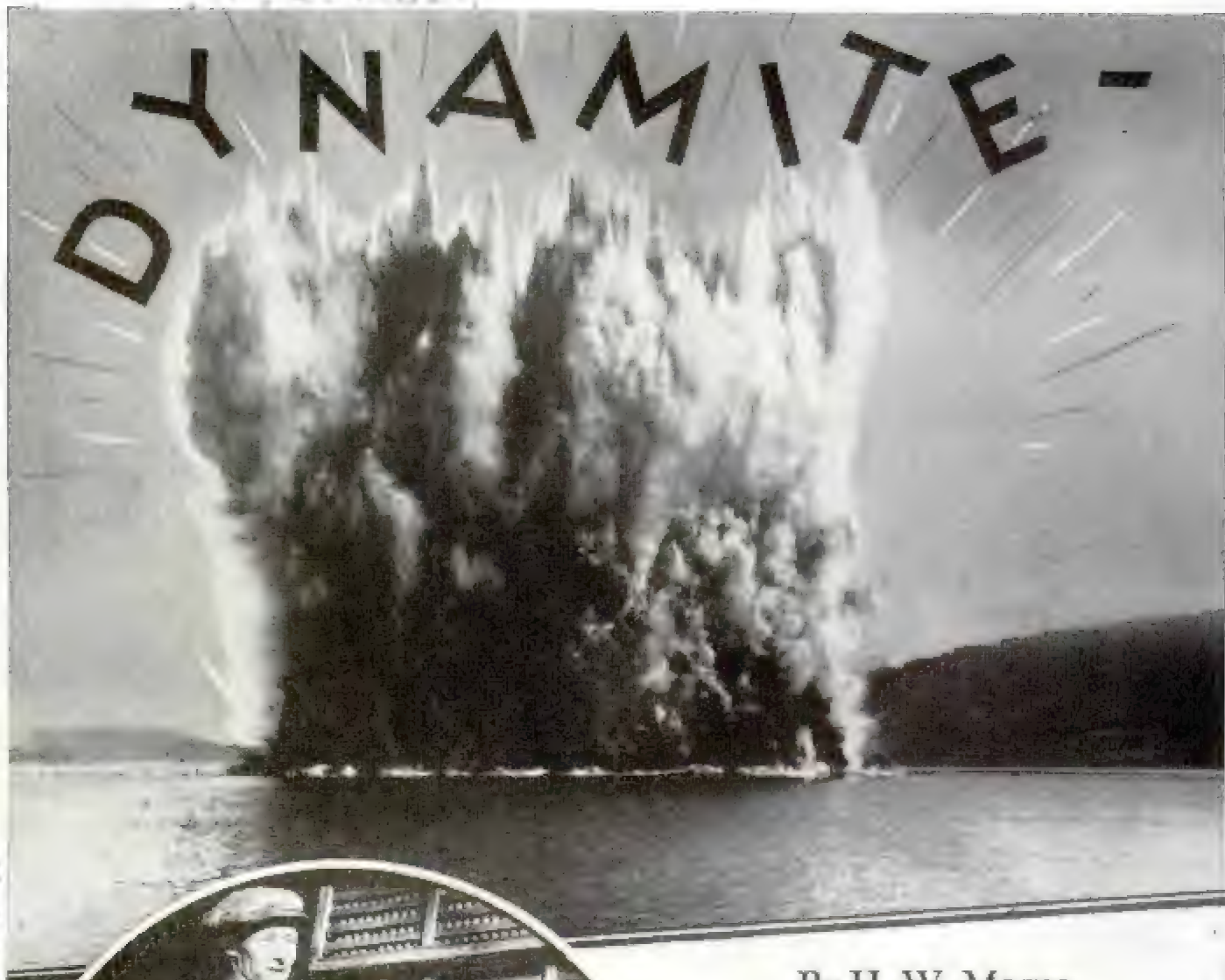
(E. Ranch Electric Co.)
Tokyo, Japan

Canada
Karlheine & Co. Montreal
Trade Commission
Gait American

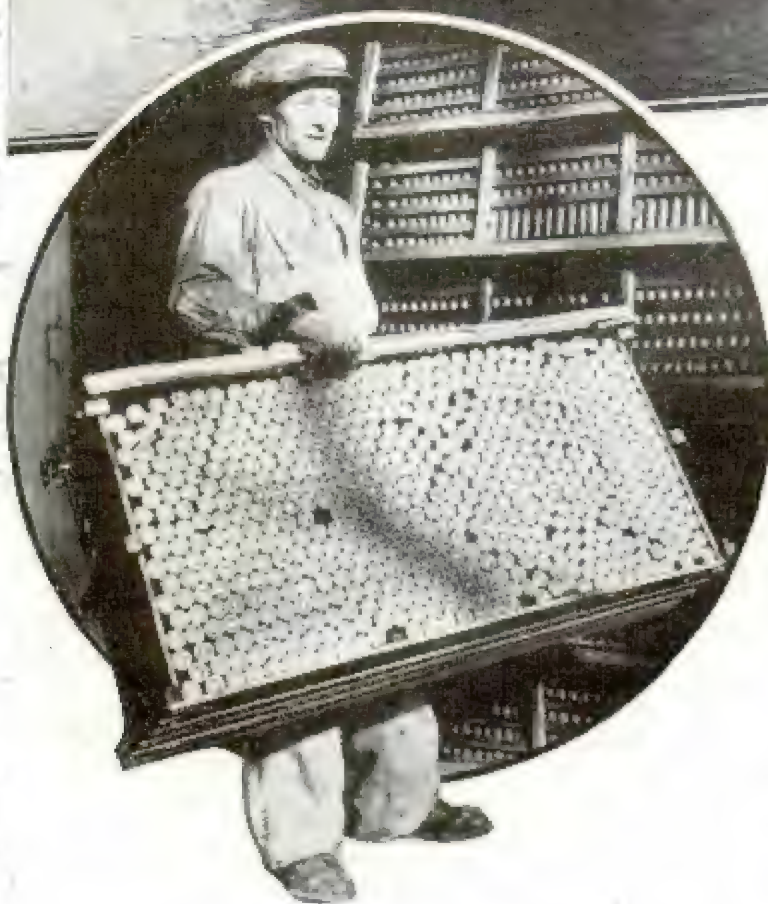
No U.S. agent.

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Es 960.

DYNAMITE



By H. W. Magee



Top, blasting a trench in bed of river for a pipe line.
Bottom, taking empty shells from the shell house to
the cartridge packing machine

DYNAMITE, one of the fastest and most powerful substances ever created by man, has altered the history of the entire world within the short space of half a century.

Today it is perhaps a better business index than steel because it enters, directly or indirectly, into the making of nearly everything we use. About 300,000,000 pounds of it were consumed in this country last year for mining, quarrying, engineering projects, harbor improvements, agriculture and many other purposes.

Without dynamite, you would be without an automobile or a concrete road on which to run it. You would be without adequate electrical power, without enough fuel, perhaps without such a simple thing as an alarm clock. Dyna-

E. C. du Pont de Nemours & Co. Inc. Wilmington, Del.

Man's MIGHTY SLAVE



mite breaks down the iron ore, coal and limestone used in making iron and steel. More dynamite supplies the coal for ships and trains which carry these raw materials to the steel mills.

The electricity in your home probably is made with coal mined with dynamite and transmitted over wires produced with the aid of dynamite.

At least 1,000 pounds of dynamite are required to clear the right-of-way and supply the stone and cement for each mile of concrete road. About 71,000,000 pounds of dynamite last year produced around 500,000,000 tons of coal, another 20,000,000 pounds were needed to get 50,000,000 tons of iron ore, 53,000,000 pounds were used to obtain gold, silver, copper, lead, zinc, aluminum and other non-ferrous metals, 150,000,000 barrels of cement rock



Top, taking loose dynamite from mixing house to cartridge packing machine. Bottom, wheeling nitroglycerin "buggy" from store house to mixing house. Note semaphores and railing to protect the "buggy" and its contents



the work is to be done in six years.

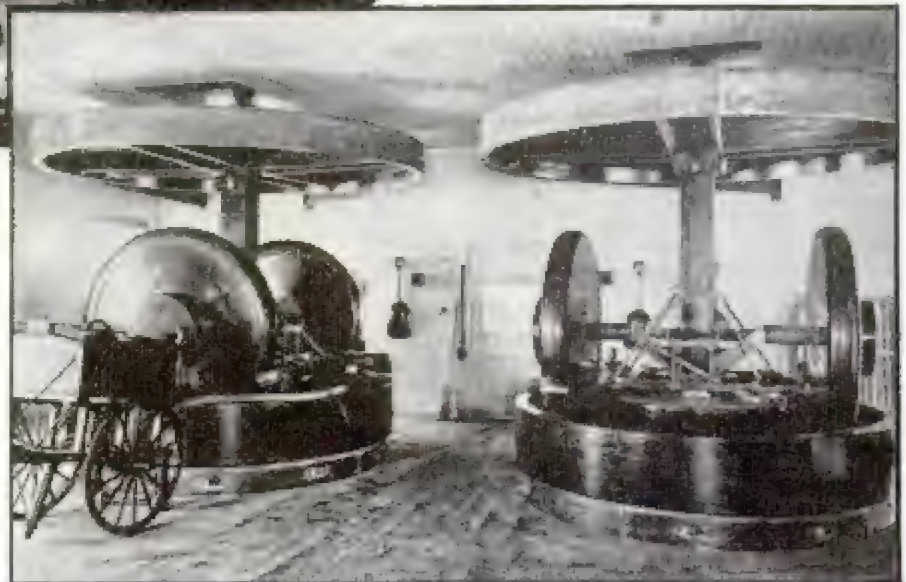
The energy of more than 10,000,000 pounds of dynamite went into the building of Boulder dam. Dr. Irving Langmuir once calculated 90,000,000,000 kilowatt-hours of electrical energy equal the energy of 70,000,000 tons of dynamite. On this basis, Boulder dam eventually will have an output of electrical energy each day more than four times as great as the energy of all the dynamite used in its construction.

A river has been

were loosened with its aid and farmers used some 6,000 tons of it for drainage work, blasting stumps and planting trees.

Trains and the tracks on which they run, ships and the engines which propel them, our bridges and highways, automobiles, trucks and many of our buildings are constructed of metal or stone obtained with dynamite. It is employed to build huge dams and—as an incidental part of drainage work—to kill tiny mosquitoes. Delicate charges of dynamite were used by Gutzon Borglum, the sculptor, to rough out the features of the cliffside figures he is carving in the Black Hills. On the other hand, as much as 440,000 pounds of the explosive have been set off in a single quarry blast to break down hundreds of thousands of tons of rock in a split second.

The aqueduct being constructed from the Colorado river to Los Angeles includes more than ninety miles of sixteen-foot tunnels. Without dynamite, it is estimated more than 1,000 years would be required to complete this project. With dynamite,



Top, one of the steps in mining limestone with aid of dynamite. Bottom, dynamite mixers, great wooden bowls in which wooden wheels revolve

straightened in an instant by a single dynamite charge which opened a channel twenty-eight feet wide, twelve feet deep and one-third of a mile long, a task which would have required months of hand and machine labor. Only with dynamite, which can be exploded under water, could many of our harbors have been opened to the vessels which ply them today. Without dynamite, rocks of Hell Gate still would bar Long Island Sound to ocean traffic.

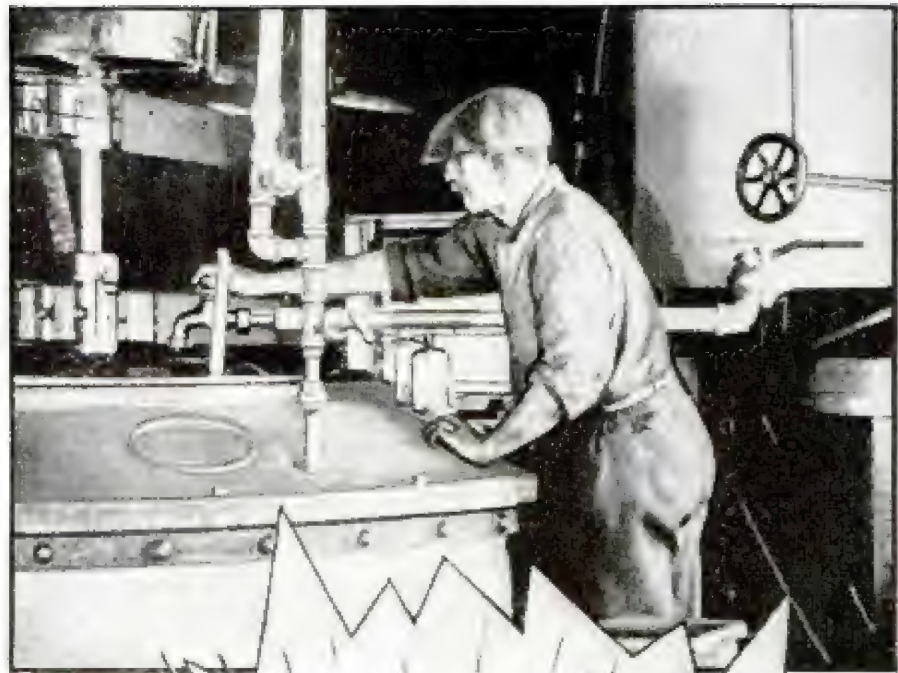
Tons of this explosive are used each year to create miniature earthquakes and then, by seismograph records, to locate domes under which are oil deposits. Other tons are employed to blast foundations for sky-

scrapers and tunnels for subways.

Dynamite is used every year by the thousands of pounds to save property and human lives—to start log jams, to blast ice gorges to release or prevent floods, to blow down whole blocks of buildings and thus check the spread of fire, to blow out oil-well blazes and to check forest fires. It is used, too, to stop soil erosion, settle highway fills, clear land of stumps, dig ditches, topple smokestacks, raze buildings, destroy old bridges and wrecked ships, and to open pipeline trenches in the bottoms of streams.

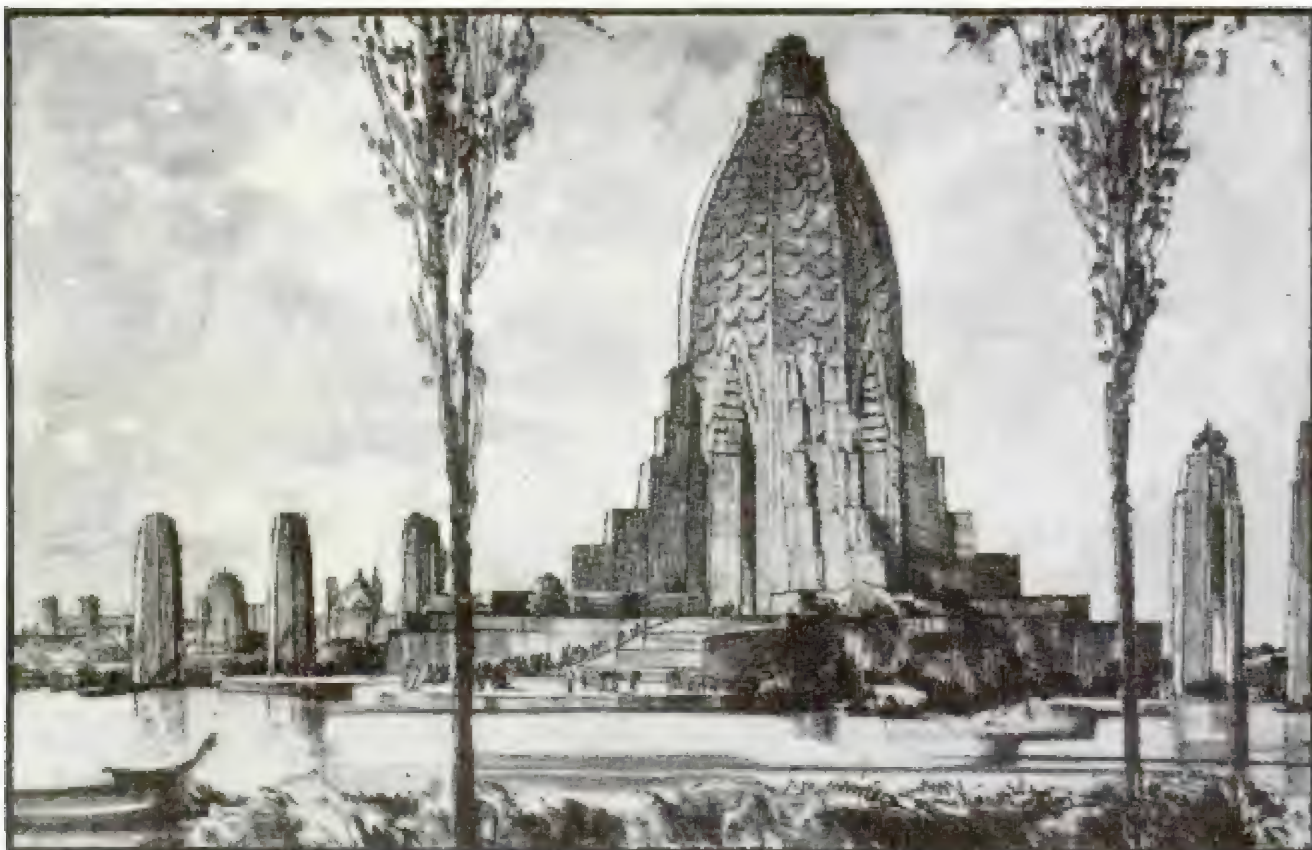
But despite its great service to mankind, dynamite is quite generally maligned, misunderstood and unappreciated. A dun-colored stick of dynamite, to many people, possesses all the deadly menace of a coiled rattlesnake. This evil reputation is undeserved. It is intended to explode, but so is the fuel in your automobile and no one con-

(Continued to page 116A)



Top, nitrator into which nitric and sulphuric acid are run and slowly mixed with refined glycerin. Center, dynamite explosion shaped like a dog. Bottom, barricades at nitroglycerin neutralizing house

Temple of Music Among Exposition Wonders



Top, drawing of the Temple of Music which will be among the wonders of the Golden Gate Exposition at San Francisco in 1939. Floating stands will approach the temple at the climax of performances. (See story on opposite page.) Bottom, air view of exposition island shows progress of work. Note the big bridge affording access to the site from either side.

Exposition Bldg, 585 Bush St
San Francisco, Calif

Floating Grandstands at Fair to Carry Audience

Among the wonders of the Golden Gate exposition in San Francisco in 1939 will be pontoon grandstands on which large audiences will be drawn across a lake by means of cables. As the climax of the performance approaches, the spectators on the floating stands will be slowly drawn toward the proscenium of the Temple of Music. The distance between the stands and the stage at the start of the performance will be 600 feet. Acting as a sounding board for the performance will be the 200-foot beehive shaped tower of the temple, with fifty-foot pylons flanking each wing. From this backdrop a broad series of glass steps will cover a brilliantly lighted cascading waterfall. The immense stage extending out into a lagoon just above the water's level will accommodate a cast of 3,000 performers. A curtain of steam, with colored lights playing upon its surface, will veil the stage until the start of the performance. Approximately 25,000 seats will be provided on the floating stands and stadia surrounding the lake.

Tray Turned into Reading Rest by Simple Adjustment

Convertible into a reading rest by a simple adjustment, the latest breakfast tray is handy for the home. Built of lightweight wood, the tray has four short legs. Its flat top may be used for serving breakfast, then may be tilted at any angle up to vertical for reading.



Using the breakfast tray as a reading rest. Note how the tray is tilted.

Electroplating with a Brush Like Painting Metal Coat



"Painting" metal on metal with the electroplating brush. Drawing shows electric circuit.

6-14 Volts - 4 to 10 amps
Electroplating jobs that once called for dismantling and moving machinery to big immersion tanks can now be done simply with an electric brush. It is much like painting metal on metal. The equipment is portable, easily transported wherever it is needed. A spring clip on the cathode or negative lead is attached to the work to be plated, and the positive lead is connected to the anode in the brush. This is dipped in the jar of electrolyte and laid on the surface, depositing the metal coat. It takes five minutes to "weld" a nickel coating five ten-thousandths of an inch thick over ten square inches. Electrolytes are available for brush-plating brass, cadmium, gold, silver, lead, nickel, tin, nickel chromium and other metals. Railroads and ship companies are using the brush method to refinish fixtures without removing them. Electric power companies brush-plate contact points with silver to eliminate corrosion. Food vats, troughs and tanks are being plated with nickel and silver economically by this system.

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Connecticut

William H. Hirsch, 4459 Beverly Blvd., Los Angeles, Calif.

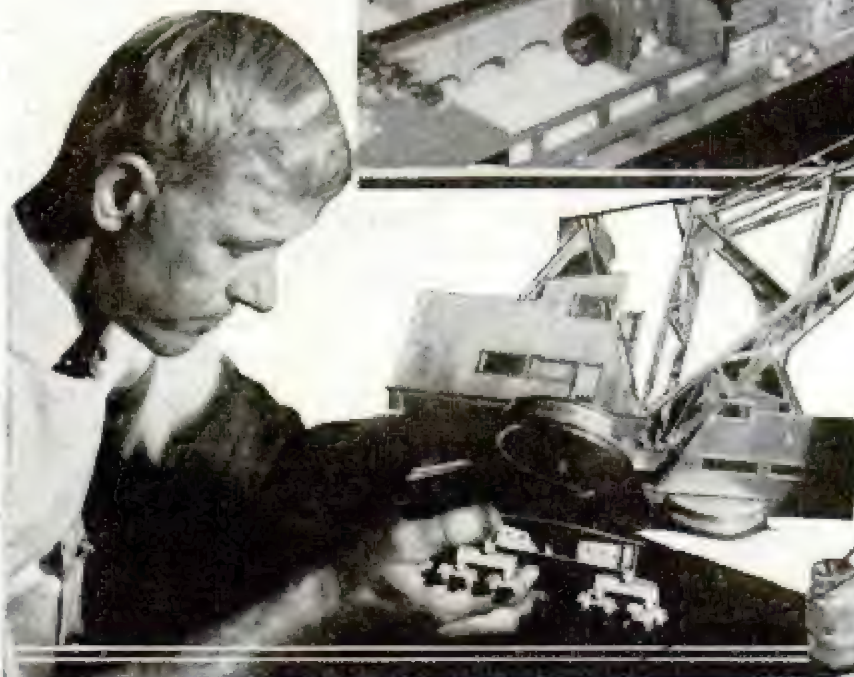
Nickel-Chromium Plating Corp. 1000 S. Michigan Ave. Chicago, Ill.

Nickel-Chromium Plating Corp.

Tiny World Made to Scale from Old Pictures



When he cannot copy the original and there are no plans available, the model builder can work from photographs or old drawings. Sculptor at top is applying finishing touches to plaster model of primitive harvester, constructed from early sketches. This is one of a series of models being made by Rosenwald Museum of Science and Industry in Chicago to depict the story of agriculture from early to modern times



Left, fitting trucks to crane reconstructed from old newspaper photograph. It is to be stationed at huge model of floating drydock in Rosenwald Museum. Above, model of city of Rochester, N. Y., with buildings, streets and river of hand-painted cardboard. Flowers are colored straw flower, trees and shrubs are pine cones painted green, and people and vehicles are toys

Made by Floyd L. H. Howell
The Howell Camera Works

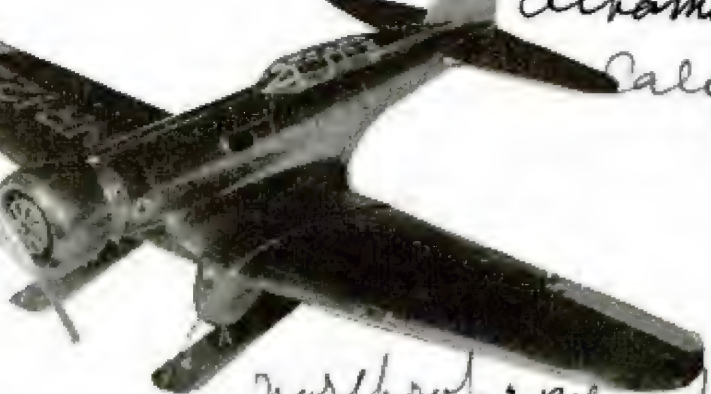
Cathedral of Pulp Tries Skill of Model Builder

Antony Schrod.

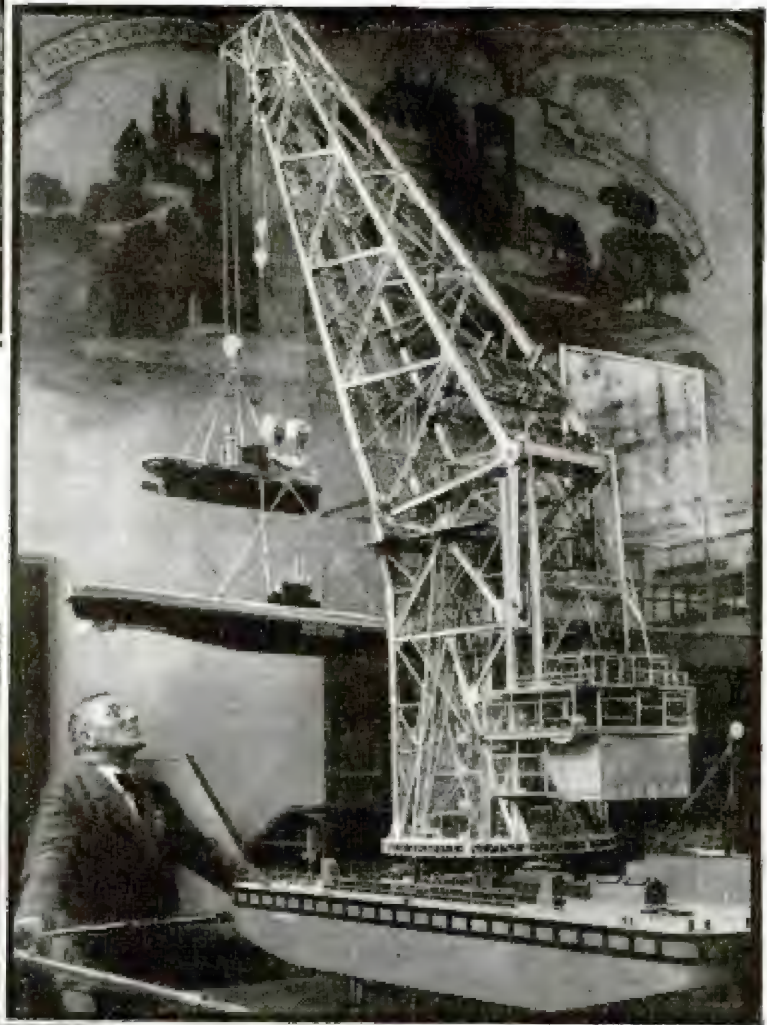
*Built by Charles Allan
Alhambra
Calif*



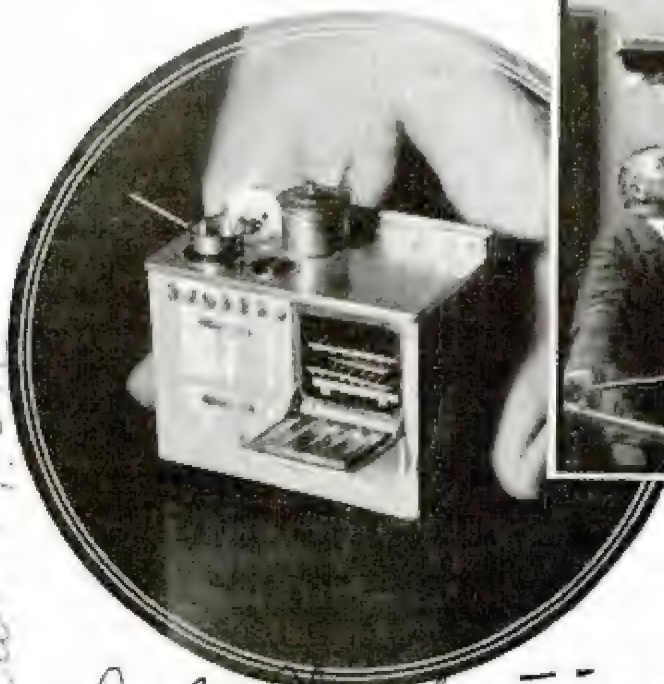
With nothing more than newspaper pulp, strips of tissue and paste, a Vienna man "sculptured" this beautiful miniature of St. Stephen's Cathedral. He used 190,000 bits of paper to reproduce its intricate carvings



Northrop Polar Star
It took a model builder more than 1,000 hours to complete three-foot copy of monoplane which Lincoln Ellsworth flew over South Pole. Fuselage and wings are surfaced with German silver and propeller is cast aluminum



Models that really work like the originals they represent are the goal of many scale model builders. The tiny electric stove at left, held between two fingers, is actually capable of cooking a meal. At right is a copy of what is believed to be the largest floating crane in the world. It is used at Wilhelmshaven docks in Germany



*Julio Charbonneau,
Seattle, Wash.*

reano 467.397

20 938 541 Splendide Blvd
Los Angeles, Calif

The SECRETS



Left, using electric lighter to prevent glare. Below, testing driver's vision for perspective to gauge her skill at estimating distance

ONLY one-fifth of all auto traffic flows after dark, but more than half of all fatal accidents happen during this time. That means your chances of ending your drive in the morgue are ten times greater after the sun goes down.

A good night driver should be badly scared all the time he is on the road, for he knows that when night falls, countless new dangers begin to haunt the nation's highways. Although he meets fewer cars, since four out of five have been safely garaged, it's four times more likely the accident will be a bad one. He knows his safe driving speed drops to the level of his headlight range—and experts give most headlights a maximum safe driving speed of not more than thirty-five miles an hour. He knows the darkness begins to play tricks with his eyes, so that objects ahead aren't as visible while he drives as they are when he's standing still. At thirty-five miles an hour, for example, his sight range is reduced by one-fourth, and at sixty, it's cut in half. That spells trouble for any pedestrian who steps out ahead of him—and he doesn't like killing people.

In his bag of tricks the good night driver has a few that may save his life a dozen times a year—and once is enough to make any of them worth while knowing and practicing. Of course, he doesn't overdrive his eyes, for he doesn't consider his eyes any better than those of a good locomotive engineer, and he would like to be as safe

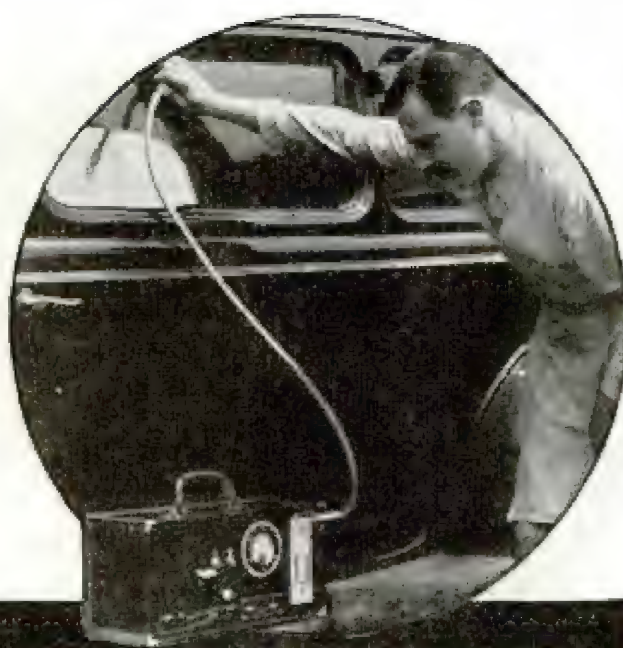


in his own car as riding in a Diesel flyer. The engineer, rushing through darkness at sixty miles an hour, sees the block signal turn red sixty seconds before he reaches the point of danger; but the motorist, even if he were so foolish as to drive at this speed, would have to act in from one to five seconds. He doesn't have any block signal to protect him, and he knows that at fifty miles an hour he would collide with an object 150 feet ahead in about two seconds. Even if he didn't lose part of this precious two seconds in the split-second it takes his brain to act, he wouldn't have a chance.

One pet trick is joggling his headlights when he is about to pass the car ahead, dipping them or flashing them full on to signal his intention. This is better than blowing the horn, which is likely to make the fellow ahead jump and to arouse his resentment. It will get cooperation because it is a courteous thing to do.

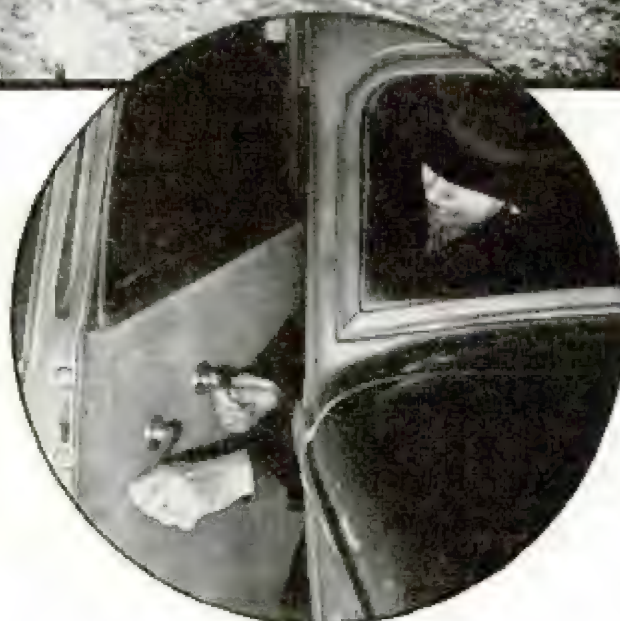
Another is to use a cigar lighter instead of a match to light his cigarette. He knows that the sudden flare of a match held close to the face is as blinding as a dazzling headlight, and leaves the eyes numbed for dangerous seconds afterward.

When he has to make a long hop after

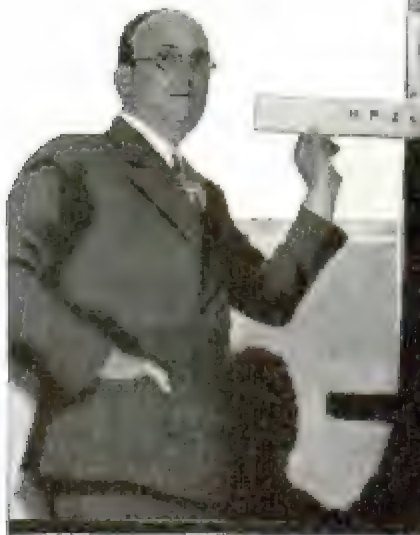


Top, testing air inside car to detect carbon-monoxide fumes. Don't drive with windows tightly closed. Center, flares protect autoists changing tire. Bottom, motorist locks himself in car to foil holdup men

dark, he watches himself closely. Of course, he doesn't drive with the windows tightly closed—if it's too cold, he starts the heater. He knows the dangers of deadly carbon monoxide seeping into a closed compartment, knows that it can kill in three minutes, or can steal over one so gradually that unconsciousness comes before it is detected. He knows, too, that a headache is likely to be a warning signal, and is on his guard. Just to give his lungs a chance to



Top, testing driver's eyes for distance. Center, pedestrian taillight. Bottom, flashlight in hip pocket protects pedestrian walking along road at night



freshen up his bloodstream and rouse sleepy organs to wakefulness, he stops the car every couple of hours and gets out and stretches, taking a few good deep breaths and leaving the car doors open to get a change of air. If he is tired but has to go on anyway, perhaps he will drink a cup of strong coffee to make sure he won't doze off. He knows that a smoothly purring motor and the fatigue coming from reflections flitting across the windows and dazzling him from the rear-view mirror, can gradually hypnotize a person until he is napping before he knows it and wakes up in the hospital. More than 20,000 accidents each year are caused by drivers who go to sleep at the wheel.

He believes in the example of the young fellow who, feeling himself getting too sleepy for safety, pulled off the road and went to sleep, leaving this note pinned under his windshield:

"Please wake me at six o'clock."

The state trooper who awoke him apologized for being twenty minutes late.

On foggy nights he is doubly cautious. He never hugs lane lines, anyway, for the fellow coming around the bend might be doing the same thing. He avoids straddling the center line, for even in daylight it's dangerous and at night there's always

the chance of running into a car without lights. When driving in the outside traffic lane he slows up, for he knows a parked car is inconspicuous, especially in the evening dusk when his lights don't seem to have much effect.

Of course, he doesn't need a policeman to tell him to get his lights adjusted if they get out of alinement. He wouldn't feel safe if he knew the car approaching was driven by a blind man—and he knows a dazzled driver is just as dangerous. He has heard that Dr. Walter I. Brown, president of the Ameri-



can Optometric Association, recommends that cars be equipped with lateral lights under the running board, or else with low-slung rear spotlights, to do away with dazzling; and he knows that until some such scheme is adopted, a fast night driver who has looked at the lights of an oncoming auto is blind until he has driven approximately 120 feet past the car. He doesn't like blind driving.

This night driver is just as careful about guarding his own eyes against glare, for a blind driver is as dangerous, no matter which car he's driving. He doesn't look directly at oncoming headlights, for he knows that when a bright light strikes his



eyes, a miraculous adjustment automatically takes place. Instantly the pupils contract to a pin point. That prevents him from getting a painful shock—but it also exposes him to serious danger. As soon as the light has disappeared, the pupils begin to expand again—not at the same lightning rate, but sixty times more slowly. During this time he can see virtually nothing, and he doesn't like to think of having his wife and children riding behind a blind man. Perhaps he has a glare shield of dark glass attached to his windshield, and at any rate, his rear-view mirror is double-faced, with a darkened side for night driving.

There's another trick that he's never used, but if the time ever comes, he won't lack the nerve to use it. That's a little scheme to foil the running-board bandit. Just the other night a Los Angeles woman used the trick when a huge man jumped on the running board while she sat wait-



Top, if a bandit jumps on the running board, starting car suddenly will throw him off balance. Bottom, testing driver's field of vision

ing for the green light, and held a big knife at her throat. Fortunately her husband, a policeman, had coached her for just such an emergency. Suddenly letting the clutch out and pressing the throttle to the floorboard, she sent the car rocketing ahead and threw the bandit sprawling on the pavement. Another driver, at the bandit's command to "Stick 'em up!" promptly slipped into gear and shot the car ahead.

(Continued to page 124A)

Navy's Flying Bomber Has 110-Volt Circuit



First of its type delivered to the navy, this air dreadnaught is trying out 110-volt circuit led by generator. It is a patrol bomber and can carry as heavy a military load as any plane in existence

Standard electric equipment and appliances on the air lines is foreshadowed by the use of a 110-volt generator for the first time on the navy's new flying dreadnaught. Aircraft today depend chiefly on twelve-volt storage batteries and a low-power generator driven by the engines. The radio transmitter is the heaviest user of power on the transport plane, requiring

890 watts. Cigarette lighters actually take more current than electric de-icers for the plane wings, the latter calling for only forty-eight watts against sixty watts for the lighter. The navy flying boat which is pioneering with 110-volt equipment is a patrol bomber, with gun turrets at the bow center and rear, and is driven by four twin wasp engines of 1,050 horsepower each.

Cows Saved by Electromagnet after Swallowing Metal



Notice metal fragments clinging to electromagnet after it was inserted in cow's stomach by surgeon

Electromagnets in the hands of skilled veterinary surgeons are saving the lives of cows that have swallowed wire, nails and other metal objects. After anesthetizing the cow, the surgeon makes an incision and inserts the sterilized electromagnet in the stomach, from which it withdraws metal fragments lodged where the surgeon cannot reach them. An automobile battery operates the magnet. It is estimated that \$30,000,000 worth of cattle die every year as a result of swallowing foreign objects.

Plastic Iron for Pipe Joints Is Immune to Corrosion

Plastic iron, as pliable as soft lead and as porous as a sponge, is being used to pack the sockets of pipe joints. It can be made quite impervious to corrosion by treatment

Sinterite

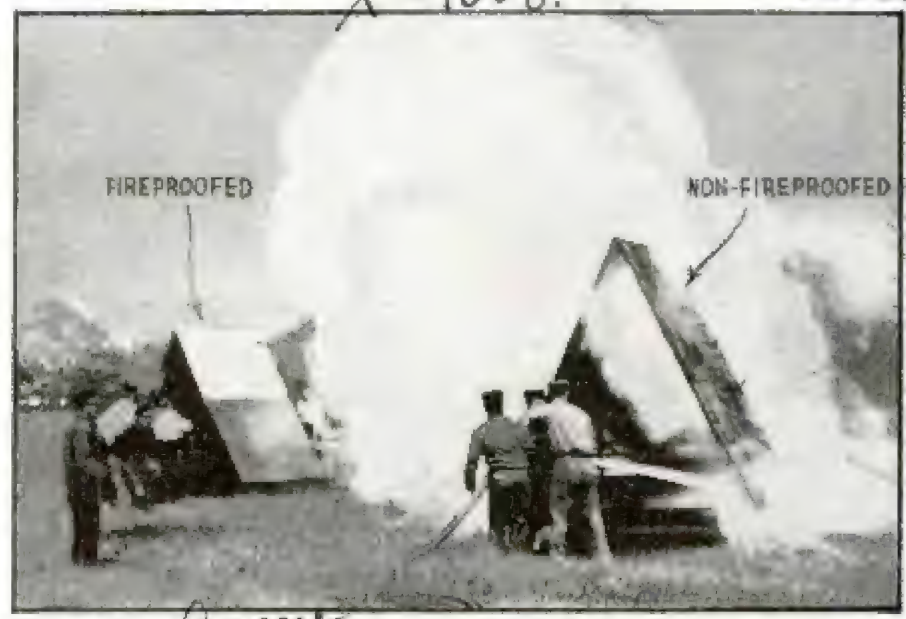
Eselschaft. Hais Vogl. K.

Popular Mechanics

Prooing Carps 671 4431 W Jefferson Street Mich.

with a bituminous mineral oil, and then is easily shaped by hammering or pressing to fit the interstice in the joint. Another advantage of this material, called sinterite iron, is that it does not generate electric energy to damage the piping.

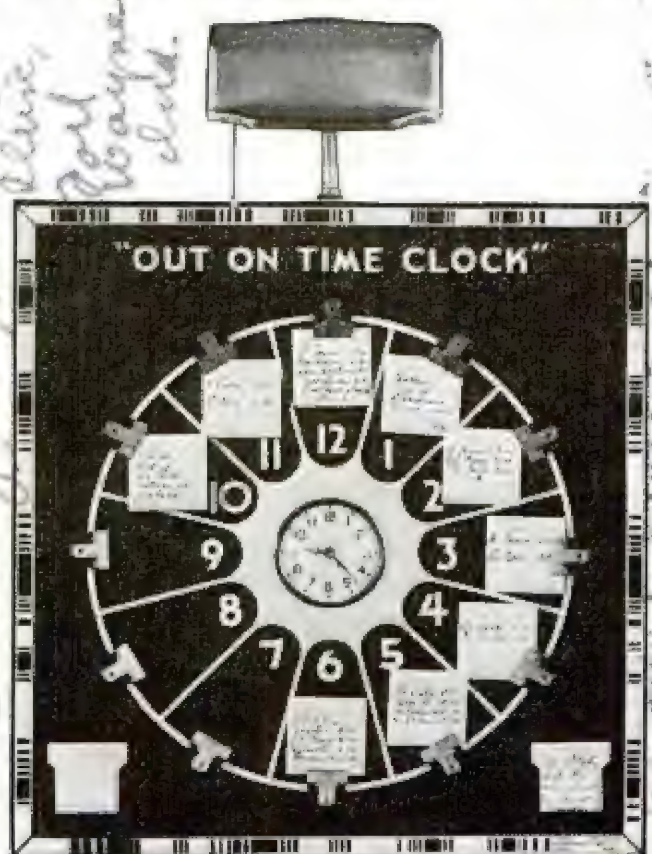
Fireproof Mixture for Paints Keeps Test Hut from Burning



Demonstration of fireproof mixture. Note hut at left is undamaged after being subjected to flames which are shown destroying hut at right

Job Slips on Clock Speed Garage Service

Designed to remind garage operator and mechanics of the time when certain jobs must be completed or an automobile delivered to the owner, hourly graduations projected outward from an electric clock allow space for attachment of slips containing details of the jobs. When a car comes into the garage, the customer's name is written on a slip, together with the time promised. The slip is clipped on the extensions and left there until the appointed hour arrives.

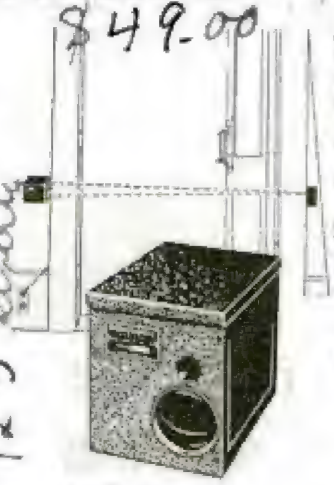


Clock which enables garage complete jobs on time

Fireproofing of paint, draperies, curtains and furniture apparently is in sight. In a recent test a hut painted with the fireproofing mixture was only scorched, while another hut covered with cheap paint was consumed by flames. The secret is a mixture compounded by Castor Rossel of Germany. It is placed in paint and in liquids which may be applied to fabrics and wood.

Electric "Eye" Rings Doorbell When Caller Severs Beam

Visitors unconsciously ring the doorbell when they interrupt the beam of an "electric eye" signal made available for residences as well as shops, where it is used as a burglar alarm. A small box mounted on a shelf at one side of the door sends a beam of light against a mirror on the opposite side, and it is reflected to another hole in the box. When the beam is interrupted a bell rings.



Conk-Clothes Junk 1409 Pemberton Ave. Port Wayne Ind.

Eye each wiring diagram included \$1.00

House Engineering Co. Pressions

Photobell Corp.

Model Plane Flies an Hour on Power of Tiny Gas Motor



Launching airplane model in "endurance contest." The tiny gasoline engine in the ship kept it in the air sixty-two minutes to win meet

Flying under its own power, a model airplane built by a Detroit youth stayed aloft one hour and two minutes to win a contest at Toledo. It was a high-winged monoplane, its wings resembling those of a bird. A tiny gas engine furnished power.

revolve, they turn the drive shaft of the junked automobile. At the end of the axle, an eccentric actuates the pump rod in an up-and-down motion.

Sander to Make Car Skidproof Mounted on Running Board



Locomotives and street cars have long had sanders for slippery rails, and now there is a sand cylinder to keep your automobile from skidding. It is mounted on the running board just in front of the rear wheel, standing twenty-seven and one-half inches high and five inches in outside diameter. A release valve is operated by a control

on the steering post, and when you feel yourself going into a skid you need only

flip the control to throw sand under the wheels. It may also be operated by the brake foot pedal. The hopper carries about fifty pounds of sand, fits any make of passenger car or light truck and can be painted to match the automobile.

Old Car Axle Used in Windmill Pump on Kansas Farm

To pump water on his farm, a Kansan contrived an ingenious arrangement combining four half-barrels and the rear axle of an old car as a windmill. The half-barrels are mounted on an old wheel to catch the wind. As they

revolve, they turn the drive shaft of the junked automobile. At the end of the axle, an eccentric actuates the pump rod in an up-and-down motion.



As wind turns half-barrels, drive shaft and rear axle of junked car revolve and pump water

"Milking Parlor" Has Glassed-In Visitors' Area

also see at Sandburgh Farm, Lockport, N.Y.



It is a long way from the old-fashioned cow barn to this modern "milking parlor" operated by a Denver dairy. Spectators watch from a glass-inclosed room. From cow to bottle the milk is not touched by hand

Milking time is "open house" in a Denver dairy, and visitors come to sit in a glass-inclosed parlor surrounded by fifteen stalls arranged around the U-shaped room. This modern "milking theater" has glazed

tile floor and walls. Milking machines timed to the cow's pulse extract the milk, pass it into pyrex receiving jars where it is weighed, then it is transferred by vacuum through pipes to the bottling room.

Wire Holder for the Baby's Bottle Makes Feeding Easy

Fashioned to support the bottle in convenient position while the baby has his milk, a handy wire rack leaves mother or nurse free to attend to other duties at the feeding hour. The bottle holder may be attached to the crib or high chair.

Projector "Paints" Stage Scene in Color against Backdrop

"Painting" stage scenery by projecting pictures against the backdrop is the latest device of stagecraft. An ordinary painted backdrop with conventional stage lighting still is obviously a painting; the same scene projected in colors is luminous and lifelike. A picture projector used for this theatrical purpose can project at a ninety-degree angle if necessary, by employing a suspended mirror.



Bottle rack in proper position to facilitate feeding milk to the baby

*General Electric Co.
A. E. Berlin*

*Sandburgh Farm
Lockport, N.Y.
5200 St.
Bromfield, Denver, Co.
Davis
Covina, Calif.*

“SOUPING UP”



EIGHTY miles an hour in a waterbug!

So predicts Dick Neal, veteran designer of outboard racing hulls and holder of four world's records.

Time was when eight miles an hour was considered a fast clip for the outboards. But that was before the designers gave any serious thought to streamlining or "souping up" the motors of the water slippers.

Within the last few years, however, the motor aces have combined their wizardry with that of the boat builders and the records have taken a beating. Each major regatta usually is highlighted with a new assault on time, and many top-notchers feel that the end of this record-smashing is not yet in sight.

With one exception, all outboard racing classes are held to factory specifications. If a driver's hull or motor does not conform to these standards, he is not permitted to compete in official regattas. Because of this fact, Neal believes the eighty-mile-an-hour mark

5947 Troost
Kansas City
Mo
Troost

The popularity of midget boat racing is indicated by this group which competed in the various events of one meet



the WATERBUGS

Ruth Perry

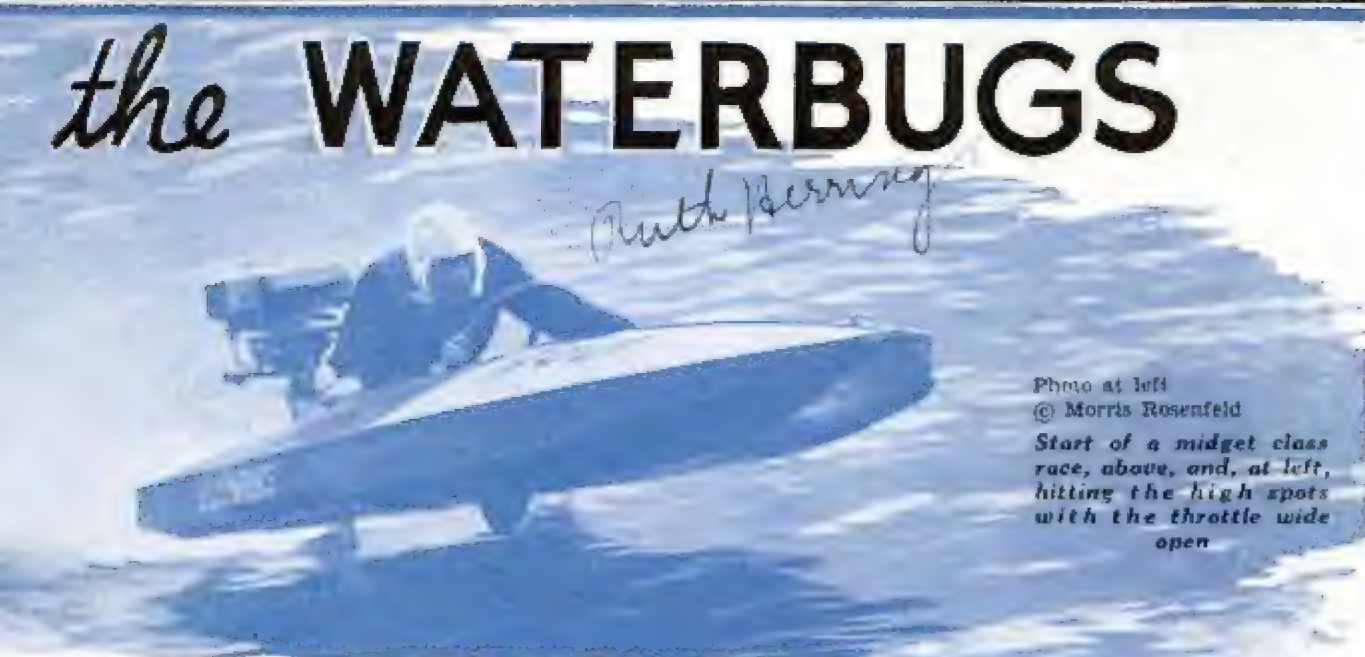


Photo at left
© Morris Rosenfeld
Start of a midget class
race, above, and, at left,
hitting the high spots
with the throttle wide
open

will come with the Class-X motors, which are not held to specifications restricting the other divisions. Jean Dupuy of France is the present title holder with a record of 74.3 land miles an hour.

Neal took up racing first as a hobby and later as a business. In ten years he has seen the speed records in the regular classes boosted from twenty-one miles an hour to fifty or better. And he's done more than his share of the boosting. Originator of many of the structural and mechanical innovations that have invaded this thrill-packed sport, Neal designs boats for many

of his rivals. "There's still a lot more speed to come out of the outboards," he says. "We keep tinkering around, trying this and that to get more speed and somehow, we always succeed."

In the early days, the racing hulls were simply flat-bottomed skiffs built on a straight plane. A smart boat builder decided to break this plane with a small step, and see what would happen. It cut down on the suction on the bottom of the boat and permitted more of it to be lifted out of the water.

With this change came additional speed



attention on craft lines. Bizarre looking units began to appear in the waters but none showed exceptional possibilities. Conservative streamlining was what was needed.

Because of the high side boards and the boxlike effect of the after part of the boats, the driver was forced to cut his speed on the turns or else take the risk of turning over. When the water slapped into this wooden wall with any force at all, a spill generally was the result. This was comparable to hitting the curb when going



Most of this racer has left the water and taken to the air. Above, building an outboard racing hull intended to compete for new records

of more than five miles an hour. However, it made the boats more difficult to handle. The proper depth of this shelf first had to be determined by trial and error methods. Then when the proper lengths of the front and after planes were established, this difficulty was overcome.

When streamlining appeared on the industrial horizon, boat men focused their

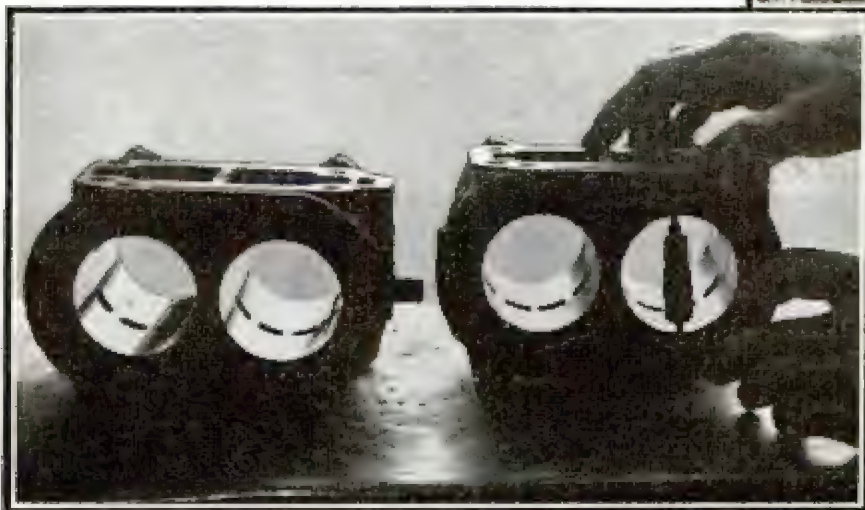
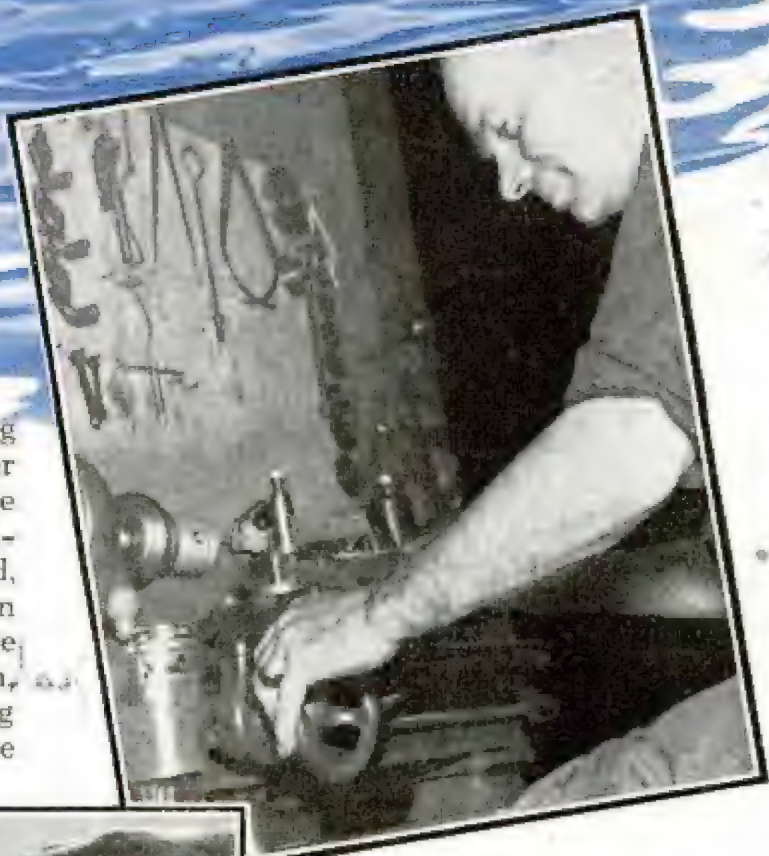
around a corner in a car. By beveling off the after part, the designers developed what is known as the non-trip chine. It is now possible for the waterbugs to negotiate the turns without cutting their speed to any appreciable extent.

Longitudinal steps that slightly overlapped one another also were conceived to enable the outboards to scoot over the wa-

Click Neal, 5947 3rd and
 29th St. Kansas City, Mo



ter with greater ease. Redesigning the forward plane with the center portion jutting out slightly added the last bit of speed that came from improving the boat itself. At top speed, the outboard now skims along on this center section. Although the boats are growing faster each season, the experts say they are becoming easier to handle. A new fuel and the



Top, outboard racer with the lines of a bullet built into its trim body. Below, cylinder at left is chrome-plated for use in outboard to be used for racing. Center, fitting pistons, part of job of "souping up" outboard motor

"souping up" of motors likewise have helped enhance the thrills of outboarding. Alcohol fuel mixed with castor oil for lubrication is used in motors of the speed aces.

By virtue of a bag of mechanical tricks, Neal can add ten or twelve miles an hour to the maximum speed of a factory motor and still stay within the specifications set forth by the racing body. Generally, this requires a complete rebuilding of a motor.

(Continued to page 122A)

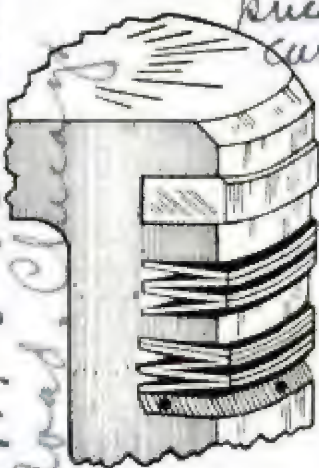
Lifeboats Ride Out a Storm on Water in Test Laboratory



Model lifeboats are given a real test of their seaworthiness in man-made "storms" on the water in an English laboratory

Life on the ocean is a bit safer today because miniature lifeboats go through miniature storms in an English laboratory. Marine designers build experimental boats and then test them under controlled conditions. By this method they are developing small boats that will ride out a storm at sea without capsizing and without shipping water.

Piston Rings Made in Segments Fit Like Facing Saucers



Segment piston rings built saucer-shaped and designed to seal worn grooves are being introduced to the automotive industry. They are placed in the groove in pairs like two saucers facing, making constant contact at

top and bottom of the ring groove at all times and preventing oil from passing around the ring. The oil film between ring and cylinder wall completes the seal, checking compression loss. Four rings are used in each one-eighth inch groove.

Handy Dry Rack Hangs on Wall or Door

Twenty-four inches long and sixteen inches wide, a handy drying rack for the home may be used on the wall, a chair back, towel bar, door or any of many other places. It will not tip over nor collapse. When not in use, the rack may be taken apart or folded for storing. It is equipped with two tin-plated hooks which are adjustable to any size towel bar. Six white birch bars hold a number of articles of clothing and several pairs of hosiery.



Here the handy clothes-drying rack is shown attached to the top of a door

Englewood Novel
Co. 1215 Yale Ave

William Faraday Laboratory
The National Physics Laboratory
Teddington, England
Valley Piston Ring
Co. 4750 Sheridan
Road, Chicago

2931 Vultee Aircraft Corp
 Downey (Los Angeles
 County) Calif

Fast ATTACK-BOMBER has 6 machine guns



Vultee Vultee
 killed you crash
 Jan. 1938

Ripping through the air at 226 miles an hour, the pilot of this fighting ship can fire four machine guns mounted in forward edge of wings while gunners in rear man weapons firing through floor and roof

Fighting power is packed into a fast little attack plane whose single engine can fling it toward the enemy at a top speed of 226 miles an hour. Not only is it armed with six machine guns, but a score of thirty-pound bombs are carried and are released by the pilot. In the forward edge of the wings four thirty-caliber machine guns are fixed. Another, on flexible mount, is manned by a gunner at the rear of the cockpit and the sixth gun can be fired

through the floor of the after-cockpit. The pilot handles controls, radio and the fixed guns in the wings, as well as the bomb releases. His mate can take over dual controls in emergency. Built by Vultee and powered with a 775-horsepower Wright Cyclone engine the clean, trim war plane can travel a 1,500-mile range at high speed. This range is extended to 2,700 miles as a bomber, with its speed reduced. Its service ceiling is 24,000 feet.

2931 Vultee Aircraft Corp
 Downey (Los Angeles
 County) Calif

2931 Vultee Aircraft Corp
 Downey (Los Angeles
 County) Calif
 Aug 14 37 P. 23

Boat Repair Shop on Wheels Carries Outboards on Roof



This auto trailer not only houses a repair shop with complete equipment for overhauling outboard motors, but carries five boats on its roof

When Gar Wood, Jr., goes after an outboard speedboat championship he takes along a complete repair shop housed in a trailer. His shop on wheels is equipped for almost every kind of service and repair work on motors, and has room for transporting five speedboats.

Watch Designed for Aviators Does More Than Tell Time



in conjunction with a slide rule. Others are combined navigating instruments and timepieces. One type of watch equipped with stopwatch button can give you, in a few seconds, the rate of climb. Pilots of Northwest Air Lines carry a watch with the dial marked into segments represent-

You can tell more than the time of day with an airline pilot's watch. Some fliers carry specially designed wrist watches enabling them to estimate their speed,

ing the company's radio schedule, reminding each trip pilot of the exact sixty seconds when he is due to report to his divisional headquarters by radio. The watch illustrated was designed by Col. Charles Lindbergh to meet his own particular requirements.

Sign on Luggage Begs a Ride for Hitch-Hiker

Hitch-hikers have found a new way of appealing for a ride. Recently there appeared on the desert at Yuma, Ariz., a hiker bound for his home in Wisconsin. On his luggage was a sign bearing the name of his home state, together with the figure of a hand, its thumb pointing to footprints in the sand leading toward a road sign. As he walked along the roadside he



If a car from his home state comes along, this hiker may get a lift

carried the luggage on his back so that drivers approaching from the rear might read and possibly give him a ride.

G.E. Cagle. Box 160 R. Yuma Ariz.

Mr. W. Hamilton Owens
National Arts Building
15 Grammercy Park
New York City, N. Y.

LAR MECHANICS

Ground Proposed for Safety

*national Arts Bldg.
15 Grammercy Park
New York City*



acme
This sketch shows layout of drivers' test course proposed for American cities. Note that almost every traffic condition is included, enabling the driver to prove his ability at the wheel

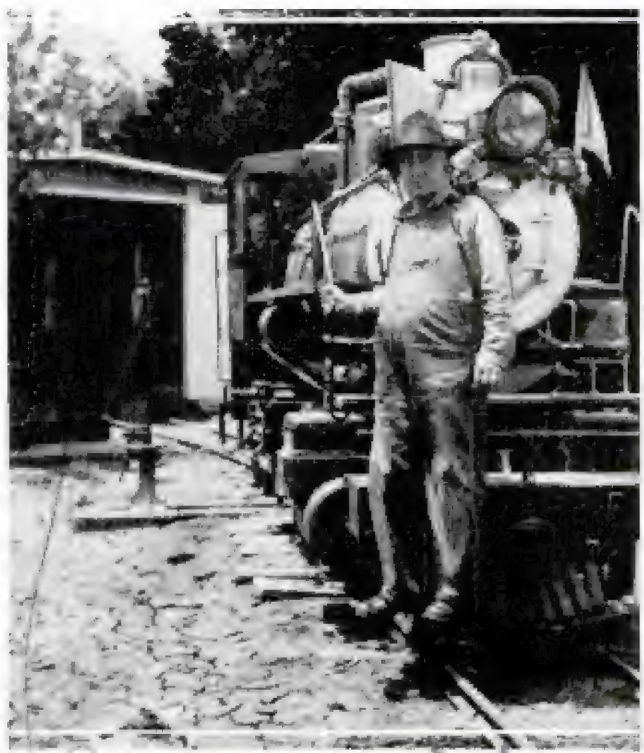
Designed to train automobile drivers, from the beginner's stage until they are qualified for operating licenses, a "proving ground" has been proposed for use in Washington and other American cities. The plan calls for one-way streets, traffic signals, safety zones and regulating signs

to be installed in a special course over which every driver would be required to maneuver his automobile. The course would be 750 by 1,000 feet. W. Hamilton Owens has copyrighted the plan, which traffic experts believe may be an aid in their campaign to reduce accidents.

Railroad on Gasoline Station Lot Is Attraction to Motorists

When a former railroad man of Pacific Junction, Ia., opened a gasoline filling station he didn't quit the railroad business entirely. He built a railroad of his own on the filling station lot. Buying the running gear of a dinky engine, and using a salvaged threshing-machine boiler and other odd parts, he constructed a locomotive to run on the 500 feet of narrow-gauge track. He graded the roadbed and laid the ties himself. The line includes several switches and an engine house. It has proved an attraction to tourists and helped build up the revenue of his gas station.

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.

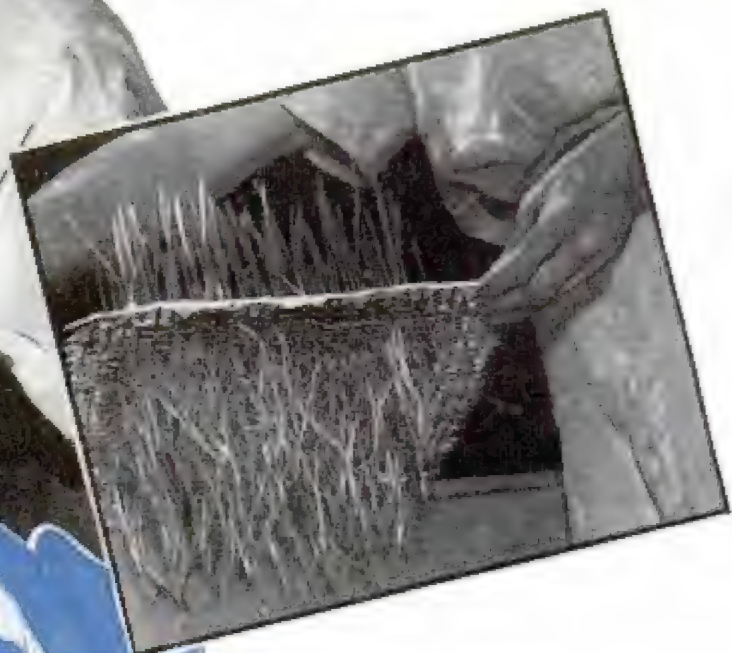


*Byron Hall
Pacific Junction*

Es 83 / 1 Corn Maxwell Reed Loran!
 54 1/2. Glendale Blvd
 Los Angeles, Calif.
MAGIC

Auxin - Eastman - Kodak Research Laboratories
 Indole Acetic Acid - Rochester, N.Y.

2.20 per gram



Top, left, decapitating oat seedlings before applying hormone poultices. Right, barley-root formations grown in tank. Below, measuring curvature produced by hormone with aid of goniometer over dish of curled seedlings

MAKING plants turn loops or sprout roots at any point you choose sounds like Hindu magic, but research wizards are doing it without trickery. At last they have discovered and reproduced in the laboratory the powerful hormone, nature's own chemical "brain," that tells a young plant how to grow. Its magic may help farmers beat the seasons, may restore sick trees to health, may stock gardens with exotic fruits and flowers now too delicate to raise outside the nursery.

The secret is a mysterious substance called auxin, generated by all growing plants. A single corn seedling daily secretes about one-millionth of a milligram of this hormone—yet this microscopic droplet that could rest on a pin point regulates the plant's movements and keeps it

growing tall and straight. Out of thousands of pounds of plant material, a Dutch scientist finally succeeded in extracting a few hundred milligrams of pure auxin. While this quantity would not make a single drop from an ordinary medicine dropper, it gave science something to work with. Before long, chemists had produced a synthetic product with similar properties, called indole-3-acetic acid. Now that they had enough to use freely in experiments, they began to test its uncanny influence over growing plants.

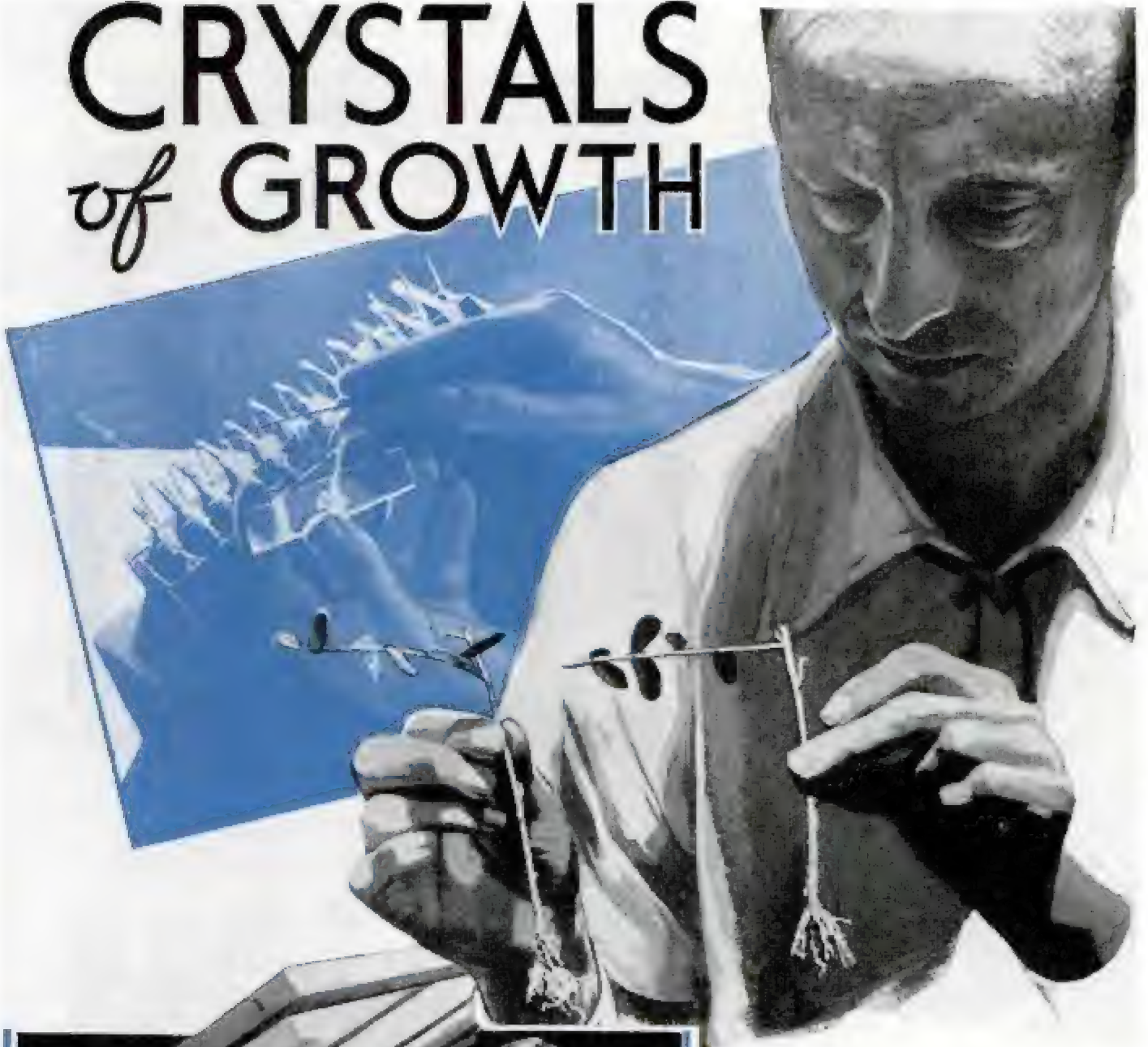
Most sensational of auxin's powers is its miraculous ability to make roots sprout. Mixing it with lanolin, a greasy fat extracted from sheep's wool, research workers prepared a salve so potent that it will almost grow roots from a billiard ball. Hard-to-root chrysanthemums and other plants that are the despair of gardeners respond splendidly. Wherever the magic ointment is applied, there a root appears.

Mallinckrodt Chemical Works, 2nd and 3rd Sts. St. Louis

see Feb. 19 36 - 207

258-57

CRYSTALS of GROWTH



Top, left, applying tiny agar blocks, soaked in hormone, to oat seedlings. Right, tree cuttings with healthy roots stimulated by hormone. Bottom, planting treated cuttings

With its aid, one research worker even caused genuine roots to grow from the petals of lilies!

Come down two flights of stairs into the subterranean laboratories of Dr. F. W. Went, at California Institute of Technology, where the new plant wizardry is being practiced. As the thick vaultlike door of the growing room closes behind you, you find yourself seemingly in total darkness. But as your eyes adjust themselves, you are aware of a dim orange radiance streaming from a photographic darkroom light. In its weird glow you see the walls are lined with trays that bristle with thousands of tiny

(Continued to page 133A)

Paradise, Calif. 682

Ancient Cedar Logs Mined in Buried Forest

Cedar trees, 500 years old, are being mined in New Jersey's buried forest near Mauricetown. Beneath many acres of the state's marshlands lie thousands of large white cedar logs, buried from five to ten feet under rich black muck. The mining operations, extensively practiced nearly a century ago, have been revived on a commercial scale, due to the high value of the logs and the peat which often extends to a depth of thirty feet. Bark is still on the logs, which are worth from \$50 to \$150 each.

Wide World



Circle, digging into marsh for buried cedars. Left, measuring one of the logs. Top, right, shingles made from the cedars are claimed to be almost indestructible

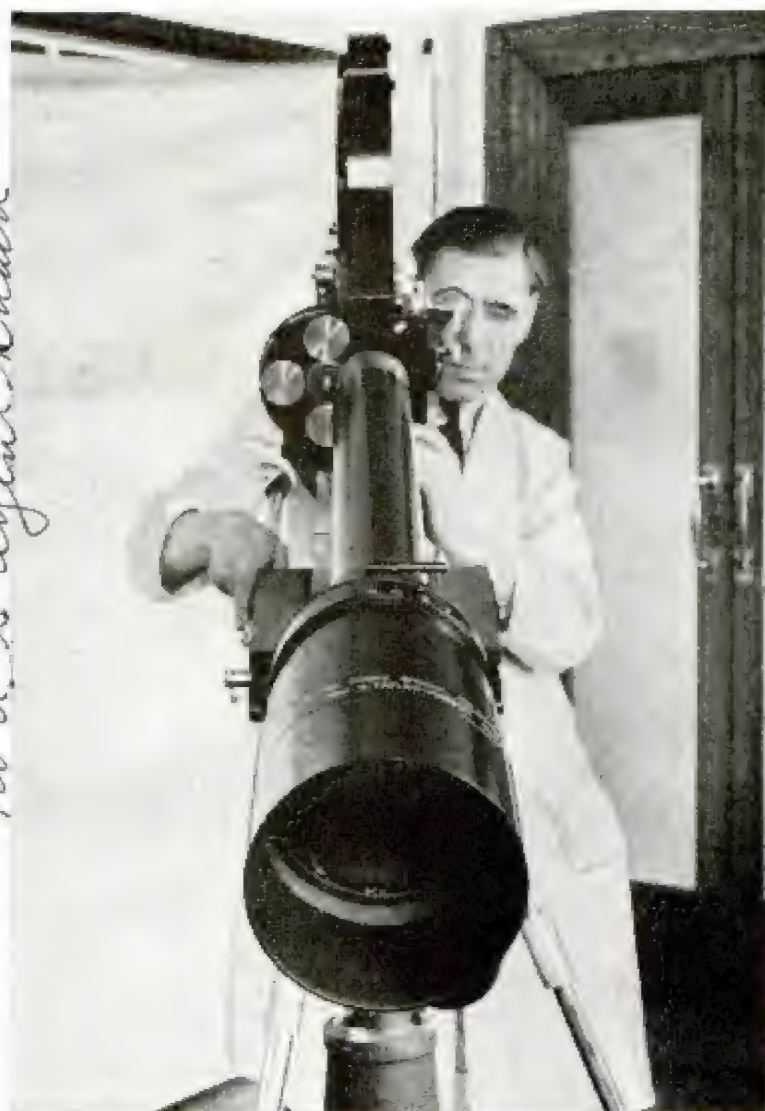
Speed-Control Lights on Automobile Are Used on Color-Zone Road

Offered as a means of reducing accidents, a new device with instrument panel switch may be set to control the speed of the automobile. The first point on the switch permits the car to go no faster than thirty miles per hour; the second permits a speed of forty-five; the third a speed of sixty, and the fourth allows unlimited operation. The switch may be locked at any speed desired and the key removed. Instead of

being a motor governor, the device throws out the clutch when the speedometer reaches the maximum point specified by the dash control. There is no interference with pickup or power. The device may be found useful in highway zoning, a new speed-control theory. One example of this type of regulation is the Minnesota plan, the groundwork of which recently became the law of that state. The law specifies that

no motorist may drive faster than thirty miles per hour in town districts, forty-five on good country highways and sixty on trunk highways. The second part of the plan, not yet made law, calls for distinctive marking of all highways with colors representing each zone: red for thirty miles per hour, blue for forty-five and green for sixty. Thus, in a forty-five mile zone, the center and shoulder lines of the road, the signs and telephone poles would be painted blue. The speed-control device lends itself to color zoning because the dash switch is linked to three colored lights mounted over the license plates, front and rear. Each color represents a point on the switch and corresponds with the color markings on the road. Upon entering a forty-five mile zone, a motorist equipped with the speed control would set the switch at forty-five and his car would show blue lights, indicating to police that the car cannot exceed the speed limit as long as the blue lights show.

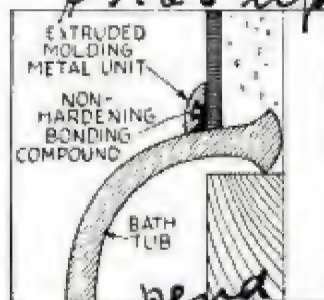
Far-Sighted Telephoto Lens Sees "Closeup" at 1,000 Feet



So big it resembles the mouth of a big gun, this seven-inch lens takes telephoto pictures that bring distant scenes close up

Tub Joints Waterproofed by Metal Molding Laid in Bonding Compound

Cracks between bathtub and wall can be sealed with a metal unit molding of extruded aluminum alloy which requires no special tools nor drilling of wall or tub to install it. The molding, available in standard lengths with corner and finial pieces, is applied with a bonding compound which hardens in eight hours. The finish is satin aluminol, which does not stain, tarnish



or rust and is impervious to hot or cold water, soap or other cleansers. The molding is of metal soft enough to follow the contour of an irregular wall.

Scenes one thousand feet distant seem "closeups" to a giant telephoto lens recently completed in an English optical factory. Described as the largest of its kind, the lens has a diameter of seven inches and a focal length of fifty-six inches, working at an aperture of f8. One of its first assignments was to photograph the British royal family on the balcony of Buckingham palace, where no ordinary camera could obtain a closeup view. It was necessary to sight through a telescope to center the picture because of the great distance. When the resulting picture was projected on the screen, it gave the audience the impression of being but a few feet from the balcony. The giant lens itself weighs thirty-five pounds.

Metal Units Co.

Bombproof Hangar in Air 'Gibraltar' Planned



Sheltered from air attack, hangars tunneled in solid rock of Yerba Buena island would make it an "air Gibraltar." In foreground is vast airport planned for Treasure island after forthcoming exposition

Yerba Buena island, the rocky anchorage for the midpoint of the new San Francisco bay bridge, would become a "Gibraltar" for the air services defending the western coast if the proposal of an army brigadier general is adopted. He suggested

that a group of bombproof hangars be tunneled in the solid rock along the base of the isle, close to the great airport which is to be constructed on Treasure island after the forthcoming San Francisco exposition closes.

Bike-Trailer Shop Is Powered by One-Cylinder Motor



Here is the operator of the bike-trailer shop at work, sharpening knives and scissors

Constructed from parts obtainable from secondhand stores and junk yards an odd bicycle-trailer vehicle is driven by a single-cylinder motor which also furnishes power for several sharpening devices, an emery wheel, an old-fashioned grindstone and a buffing wheel. The bicycle is attached to a trailer made from the parts of a motorcycle sidecar and wheels and axle from an old-model low-priced car. The motor, similar to those used to run farm lighting systems, is connected to a pulley, made from an old clincher rim, on the rear wheel of the bicycle. This arrangement gives the vehicle a speed of about thirty miles per hour, with a gasoline mileage of nearly seventy to the gallon. When the

owner desires to sharpen knives, saws, scissors or lawnmowers, a job at which he makes a living, he disconnects the motor from the drive wheel and attaches a belt with which the grinding wheels are driven. The bike-trailer enables the owner to take his shop right to the customer's door.

Tail Gate of Truck Used as Elevator for Loading

Truck men find it easy to load and unload heavy merchandise when the tail gate of the truck is an elevator. It travels vertically under controlled speed, which is governed by the speed of the truck motor. It can be stopped or started at any point, and is held flush with the truck floor by a positive lock which prevents sagging even with heavy loads. This newly developed tail gate can be built into a new truck or installed in an old chassis.



Heavy merchandise can be loaded or unloaded from truck by using tail gate as elevator run by motor

Camouflage on Battle Plane Gives Appearance of Clouds



Painted in this odd manner, this plane is difficult to see against the clouds. The camouflage closely resembles the effect of clouds

Camouflage is being used experimentally on Great Britain's battle planes to make the craft resemble the clouds. The work is similar to that employed to partially conceal steamships from the enemy's eyes during the world war.

Smoke Reducer for Furnace Promotes Combustion

Installed in the smokestack of a lumber company's furnace, a smoke-reducing device is proving effective as it promotes combustion. It is a turbulator which feeds air into the furnace above the fire bed, causing the flames to consume much material that otherwise would go up the chimney. The device permits the burning of fuel at a rate sufficient to put two and one-half times normal load on the boiler.

Lang Industries

and G. W. Perry

British Royal Air Force

Jacrey Aviation Co. Ltd
Hayes, Middlesex
England

Letter returned 4/15/39.
Concinnati
Ches

8/7/37

Water Wheel Yields Power for Lights and Cooking at Inn



Nine-foot water wheel drives direct-current ten-kilowatt generator supplying power for electric cooking and lighting at inn

From a stream flowing past his inn near Point Pleasant, Pa., the owner gathers enough power to operate his place through the spring, summer and autumn. He installed a nine-foot water wheel and geared it to a direct-current ten-kilowatt generator, which supplies the current for lighting, cooking and electrical appliances.

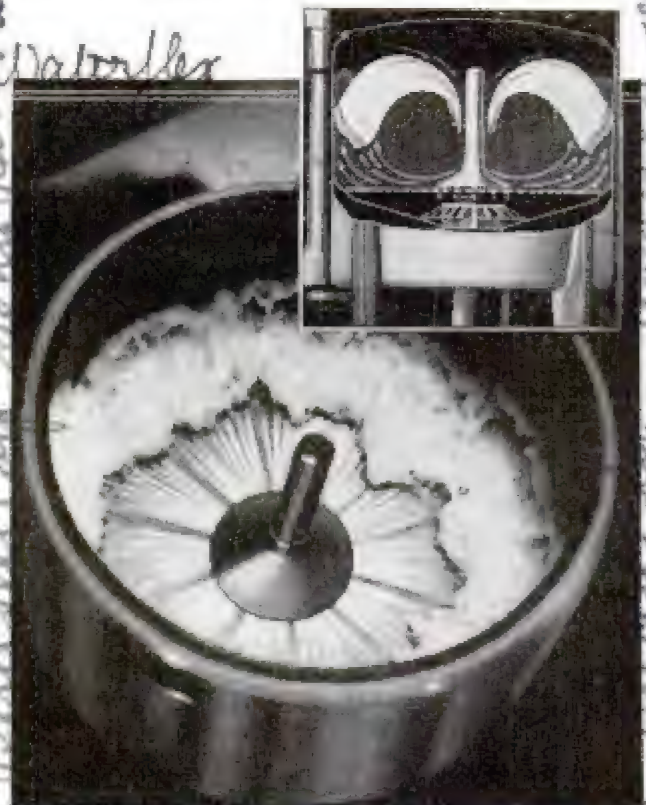
Utilities Rush New Generators as Demand Nears Capacity

With consumption of electric energy exceeding all records and pressing close to the nation's estimated generating capacity of around 34,500,000 kilowatts, public utilities are racing to build additional generators lest demand for power actually outstrip production. Engineers now are installing equipment to add 800,000 kilowatts, and by the end of 1937 the industry expects to have capacity for 2,370,000,000 kilowatt-hours per week. But power consumption found a new peak of 2,300,547,000 kilowatt-hours in the week ended Aug. 14, and based on the usual gain in demand from midsummer to the year end, the Christmas week demand for electricity

might reach between 2,395,000,000 and 2,465,000,000 kilowatt-hours, thus exceeding the rated capacity of the generating plants. C. W. Kellogg, president of the Edison Electric Institute, points out that modern equipment permits utilities to run twenty per cent above stated capacities at intervals, and he anticipates no power shortage.

Washer Without Agitator Lets Water Flex Clothes

There is no agitator, no moving part to touch the clothes in a household washing machine which goes on the market this fall. An aluminum impeller forces water from the center post at high velocity across the floor of the tub, and the water surges up the outer wall and back into the center, keeping the clothes in constant circulation and causing them to flex and rub. Delicate fabrics can be washed without danger of tearing or stretching. The motor, which drives the impeller through an automotive type clutch, is easily removed in one minute.



Water forced from center post of washer keeps clothes circulating in direction shown by diagram

'Mike' Specialist Assigns 'Ears' for Broadcast

There is a right and a wrong microphone for every sound effect, and radio broadcasting has developed now to the point where a microphone specialist is required. This fall the National Broadcasting company is placing a microphone technician in charge of choosing the proper "ears" for a broadcast and installing them in the best location for the pickup. He may use one of the four general types of "mikes" or he may arrange a combination of two or three types to bring out certain effects or overcome obstacles. The parabolic microphone is ordinarily used for outdoor pickups where reception over a wide angle but from a single direction is desired. The microphone is at the focus of the parabola of a reflector which gathers up the sound waves coming from one direction. It is



Above, microphone technician stationing one of radio's big "ears" to pick up theater broadcast. Left, four types of "mikes" and, below, their fields of pickup. Left to right, parabolic, camera condenser, uni-directional and standard velocity microphones

used in theaters and opera houses as well as for outdoor pickups of football cheering sections, bands and crowd noises. The camera condenser microphone is used in the field, picking up sound from a circle around it. The uni-directional microphone is sensitive to sound coming from only one side, thus making it possible to eliminate audience noises in a studio and to focus on certain parts of orchestra and stage in an opera broadcast. The pickup area of the standard velocity or ribbon-type mike forms a figure-eight pattern. It has a thin, corrugated aluminum ribbon mounted between the pole faces of permanent magnets. The ribbon vibrates when sound waves strike it from either side, and this motion cuts the lines of flux of the magnets and induces a voltage in the ribbon.

Flexible Diesel Exhaust Pipe Absorbs Shock from Motor

Flexible metal exhaust piping designed to endure the pounding, pulsating exhaust from Diesel engines is now offered. It has a four-wall interlocking joint construction that remains tight despite constant weaving. Where cooling is desired, the flexible tube is jacketed with a larger size of the same piping, leaving an air-cooling space so that the outer jacket always remains cool to the touch.



Pennsylvania Flexible Metallic Tubing Co.

Es 951.

#2056, 840

72nd St. and Passaic, N.J. Phila.

RADIO MUSIC



Left, special microphone for bass fiddle gives steady, pounding beat of a powerhouse. Below, sea shell provides illusion of distance to trumpet



From the loudspeaker you first hear the beat of tom-toms apparently coming from a long way off. There is no resemblance of "fading in," the radio term for starting at a distance from the microphone and gradually

Photographs courtesy
Columbia Broadcasting System

485 Modern are useful

TONES unlike any ever heard before will flow from radio receivers when musicians reach an advanced stage in experiments whose purpose is the production of new sounds with the aid of the microphone, amplification and the mixing panel of the broadcast station's control room.

Composers of this music of the future necessarily will be engineer-musicians.

In the New York studios of the Columbia Broadcasting System, a young man who is both an engineer and a musician is creating something new in tones. If you dropped into the control room of the studios today you might hear his quintet rehearsing "Dinner Music for a Pack of Hungry Cannibals."

moving the instrument closer. Instead you get the impression that you are moving toward the sound. Next there is the sound of instruments strangely unlike any we know, playing a weird off-key melody that gives an impression of savages with crude, hand-made flutes and pipes. A wild cry that might echo through the jungle startles you and then a gurgling sound gives the effect of water boiling in a pot. The strange music clearly describes the scene, that of a cannibal orgy.

Raymond Scott, the young engineer-musician, tells how it is done:

"You're on a ship moving toward a desert island. You hear tom-toms a long way off. Through a spyglass may be seen can-

of the FUTURE



nibals gathered around a big, black pot, listening to their dinner concert.

"To get the effect of distance for the drums we placed a sea shell beside the microphone. When the drummer beats the tom-tom the sea shell picks it up on the microphone and gives it that hollow, far-away sound. As the music gets closer we turn off the sea-shell mike. Next we made our saxophone and clarinet sound like the mumblings of savages. We did this microphonically and musically. The distance the musicians stand from the mike was controlled to get the right dynamics. The weird music is the result of playing an F scale with a G flat in it, instead

Raymond Scott even gives the piano an ethereal tone. Top, trio playing in strange scale to give savage effect to music



of straight F scale. By having our trumpet player blow an actual melody into a bucket of water, close to the mike, we got the boiling-water effect without sacrificing any of the melody. The sound was clearly audible even above the rest of the music, which was loud and furious. Under normal conditions the bubbling sound produced by merely blowing into water would not have been audible six feet away.

"Without the microphone the music wouldn't sound like anything, in fact you probably couldn't even hear many of these effects."

Scott has tried out everything that occurred to him that might evolve new sounds on the microphone. For instance, he spent hours recording the different sounds made when he rubbed the palms of

his hands across the rims of crystal glasses filled with varying quantities of water. Among other things he found that if the glasses were placed on the thick Manhattan telephone directory, he got a different sound than when they were on the thinner Queens phone book.

Experiments like these helped him evolve his theory of "creative acoustics," which he describes as simply the business of producing, by a knowledge of microphone technique, sounds that either do not exist or that would not exist if it were not for the mike.

Amplification is responsible for many of Scott's effects.

In a number called "Reckless Night on an Ocean Liner," the sound of water lapping against the side of the ship while gaiety reigns far up on



Blowing trumpet in water to suggest boiling water over air and, below, suggesting picture of dancing girls in an oriental square

"A" deck is achieved by placing a special microphone beside the cymbals while a double wire whisk is brushed over them. The sound cannot be heard above the noise of the festivities and gay music until the special mike is installed. Then you get the entire liquid effect without interfering with the rest of the music.

"Twilight in Turkey" is a selection which pictures an oriental square at dusk, with caravans lumbering by, dancing girls



Scott and his musicians and, right, wire which on cymbal makes noise of lapping water

whirling in the soft light and a snake charmer playing his flute. None of these sounds is specifically reproduced. Instead, they are suggested by skillful placing of the microphone. One musician removes the mouthpiece of his clarinet and plays a familiar oriental melody. The mike picks up a tone which is not a clarinet tone, but one very suggestive of the exotic quality of the music of flutes heard in a far eastern city. Another musician plays an ordinary New Year's noise maker and through the loudspeaker come the confused sounds of a crowd in the oriental city. A third musician manipulates two small cymbals fastened to the fingers of his right hand, while he plays the trumpet with his left, suggesting in tone the eastern dancing girls.

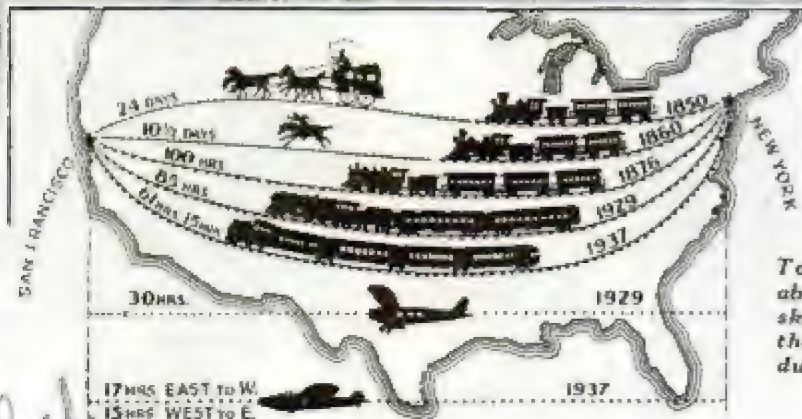
In "Power House," the problem was to suggest the constant whirl of machinery,



the pound of the dynamo and the sound of hammers on steel. By actually humming into their instruments as they played, a droning murmur is produced in the loudspeaker. In the studio without the aid of the microphone it sounds like a confused mumble, instead of the rhythm of working machinery. The beat of the powerhouse is produced by placing a special microphone

(Continued to page 130A)

Four-Mile-a-Minute Plane Has Safety Flap



Top, latest super-airliner attains speeds above four miles per minute. Bottom, sketch shows how travel time between the Atlantic and Pacific has been reduced from 1850 to 1937. It also compares train and plane time

Among the safety features of the super-fast airliner under construction for various transport companies is a new type of air flap. Used for landing and for taking off, the flaps permit the big ship to contact the ground at sixty-five miles per hour and reduce takeoff distance by eighteen per cent. With a passenger capacity of eleven, the ship has a top speed of 250

miles per hour and a cruising speed of 230 miles per hour, approximately four miles per minute. It is regarded as the fastest commercial airplane in the world. The craft has a wing spread of sixty-five feet six inches, a total length of forty-four feet three inches, and the fuel consumption is fifty-five gallons per hour. A crew of three operates the liner.

"World's Oldest Gas Station" Is Built of Petrified Wood

They call a certain gasoline station in Lamar, Colo., the "oldest in the world."

The station itself is quite modern, but its building material is estimated to be 175,000,000 years old. It was constructed of petrified wood, erected by the owner himself, and gathered from a prehistoric forest south of Lamar. It is lighter than real stone and much more durable than wood.



Filling station in Colorado built of petrified wood

Frog-Like Chorus of Sea Birds Recorded by Short-Wave Set

With the aid of radio short waves, Atlantic petrels on the Bay of Fundy have for the first time serenaded man with their frog-like chorus recorded on sound films. Because it was impossible to get a sound truck near the island home of the birds,

operated by Polyvinyl
L multi

es 930
es 966
es 977

the ornithologists seeking to record their song laid a mile of wire from a short-wave radio station to the petrel colony. At night, when the male birds sang the croaking chorus, the microphone with parabolic reflector picked up the noise and an amplifier helped send it to the radio station, whence it was relayed across six miles of water to the sound truck.

Knotted Ropes Help Painters to Scale High Tower

Alpine experience would be useful to the painters assigned to decorating the tall columns at the main entrance to the Paris exposition. Instead of using ladders, they had to scale the towers on knotted ropes, climbing knot by knot to the top.



Instead of scaffolding or ladder, painters scale Paris exposition towers by using knotted ropes

Camera Snaps Narrow Escape of Driver in Overturning Car



When this racing car overturned, the photographer snapped it in midair. Note the driver still in his seat. He was not injured.

When his speeding car hurtled sideways along the track and then overturned, a racing driver on a Chicago speedway had a narrow escape. He rode the car through the wreck and then climbed from it unhurt. An alert photographer, standing near the rail, caught an unusual picture of the accident just as the racing auto was in the act of turning over in the air.

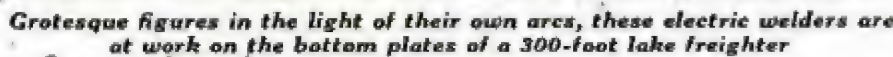
Rubber-Cushioned Roller Skate Gives a Smoother Ride

Rubber cushions your ride at four points on a smooth and silent roller skate introduced recently. There are rubber treads

to grip sole and heel firmly. The wheels, too, have rubber treads, rolling quietly on the sidewalk and absorbing vibration. Rubber mountings on the underframe take more of the jolts away, and finally a sponge-rubber guard on the strap gives it a snug, comfortable fit at the ankle.

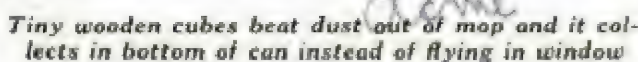


Metal Specialties
Mfg. Co. 3200



Shaker Beats Dust Out of Mop and Collects It in a Can

er. The mop is placed in the can, its handle protruding through the cover, then revolved swiftly. Little wooden cubes in the container beat the dust out of the mop and it falls through a sievelike grate and collects in the bottom, whence it can be dumped without blowing back in the window. The housewife's invention won mention on a radio program.



Plastics Lend Color to Doors in Knobs and Escutcheons

orative scheme at will. The escutcheons are of molded plastic with metal inset, thus



Lockwood Hardware
Miss G. Fitchburg

enabling the home owner to carry the color scheme of the knob into the door itself. Black, ivory, green, orchid, yellow, delphinium blue and Chinese red are the colors offered. The material is resistant to perspiration and will not crack or craze. It can be wiped clean with a damp cloth.

Mirror for Chair Shows Back of Head

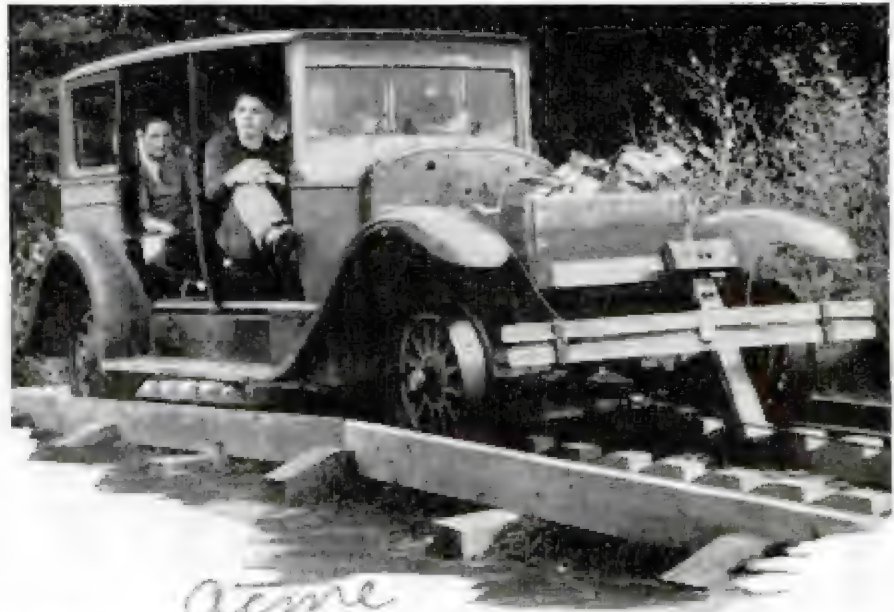
Fitted with a control by means of which it may be turned in an arc to show the back and sides of the head, a new mirror may be attached to the boudoir chair. The mirror, while being turned, reflects the image of the back of the head in the stationary mirror of the dressing table, eliminating twisting and turning. The mirror is handy for the home or the hair-dressing parlor.



This mirror is movable so that any part of the head can be reflected in stationary mirror

Reflectone Corp.
New Haven Conn.

Cable Car for Lazy Golfers Hauls Them Up Hill to Green



Golfers stack their bags where the engine used to be and ride this converted cable car up hill to the green on an Oswego, Ore., course

Golf at Oswego, Ore., isn't "on the level," and one eighty-foot hill was too much for tired golfers so they installed a cable car. It was an old automobile that had seen better days. With engine removed, it was placed on a track notched for safety and now carries lazy golfers up the hill to the next green.

Exerciser to Strengthen Hand Has Adjustable Tension

If your work requires a sturdy hand grip, there is a special exerciser on the market to strengthen your hand. Built simply, it has two wooden handles which are held apart by a strong spring inclosed in a small metal case.

The tension is adjustable to meet your particular needs in exercising.



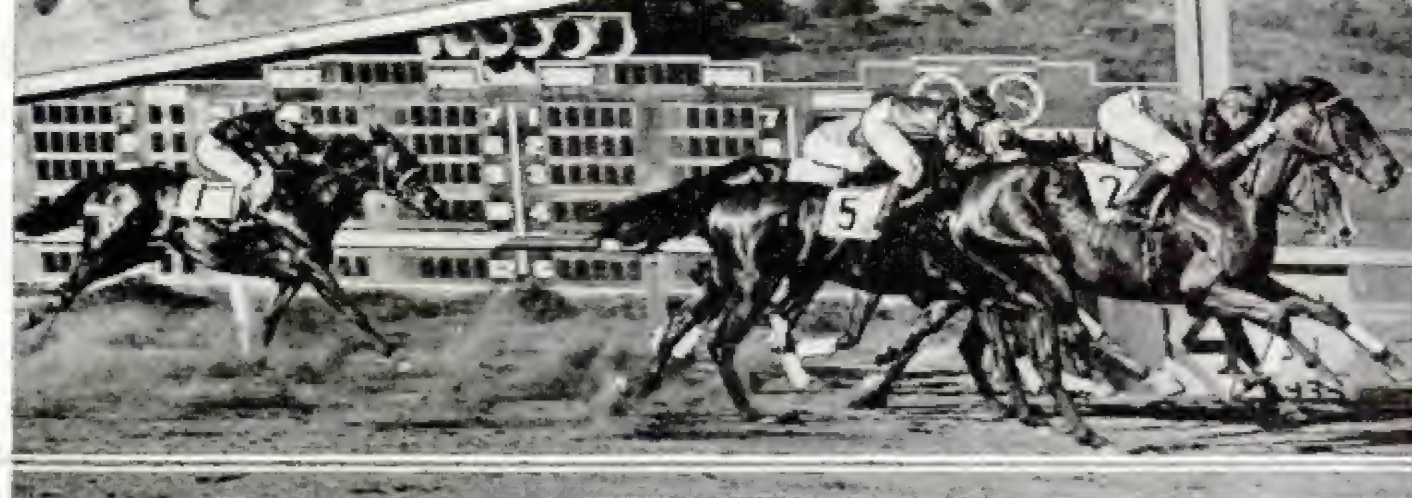
Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

Louis Schmitt
Box 296,
New Haven, Conn.

SCHOOL DAYS



Left, colt following at shoulder of lead pony. Below, close finish between full-fledged race horses at Santa Anita track in California



"LOOK at that horse!" cried an excited spectator at a race featuring two-year-olds. "He never ran before and he's going down the track like a champion. He doesn't have to be told how to win!"

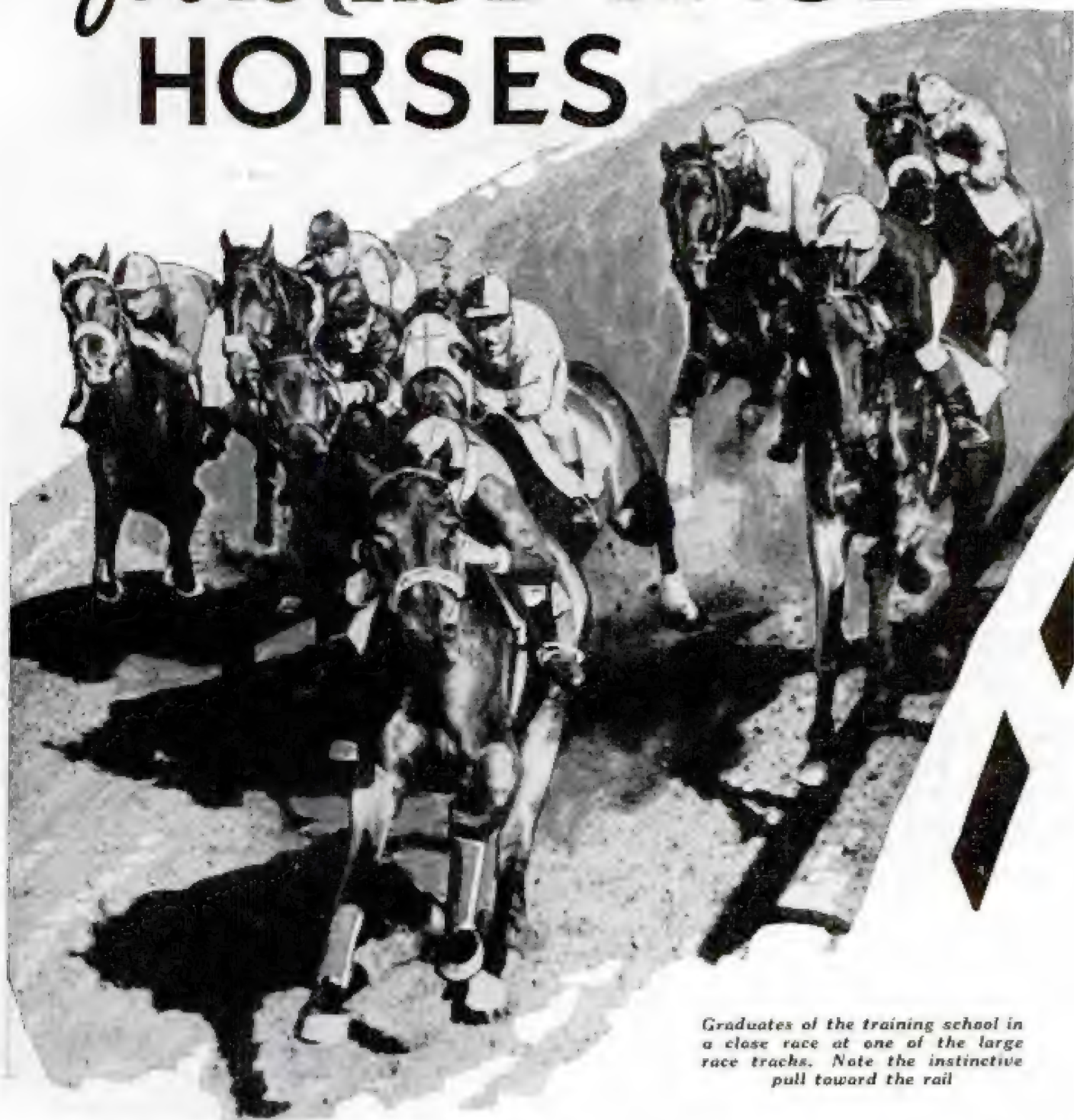
"He's running like a champion, all right," agreed a horse owner standing near by, "but some one taught him how. He's winning because he remembers what he learned in school. He'd probably throw his rider and jump the fence if he hadn't been taught how to race."

You can pick out the well-trained horses in a race for beginners just by the way they fight for the fence and stretch out into a fast pace. Some of them behave like veterans the first time they appear in pub-

lic. Before any thoroughbred is ready for the track he goes to school and learns his business just like any other performer. His chief tutor is an experienced animal known as a lead pony, and there are several wise old race horses on the school faculty as well as the human trainers and stable boys who take care of him.

On the 5,000-acre Rancho San Luis Rey near Bonsall, Calif., thirty to forty baby thoroughbreds are raised and trained every year. Operated by Charles E. Cooper, the ranch has training paddocks, stables, student tracks, and even its own private airplane landing field. At this school the future stars of the tracks start their training a few days after they are born, shortly

for *BABY* RACE HORSES



Graduates of the training school in a close race at one of the large race tracks. Note the instinctive pull toward the rail

after the first of the year. From then until their second birthday, which arbitrarily falls on the second January 1 after they are born, the colts go to school every day. Instead of being broken in the ordinary western style to carry a saddle and rider, the youngsters are made accustomed to humans and harness by gentle step-by-step instruction.

"Thoroughbreds are high-spirited, nervous creatures," Cooper explains. "Letting

them run wild and then breaking them like cow ponies is apt to break their spirit and courage. At the school we keep them gentle from the time they are babies. This takes a lot of time and constant petting and handling, but we get high-spirited animals that are able to run and that are not afraid of the crowds one finds at a track."

The first thing the trainer does is put a rope around a colt's neck when it is only a few days old. Just as long as he doesn't



Top, preparing to pull colt's tooth. Center, start of training race. Bottom, treating horse's muscles with electric pads



try to lead the colt too far away from its mother, the baby follows the trainer easily. For the next three months the routine with each baby horse is to pet and talk to it and lead it around with the rope. By that time the colts look forward to the daily visits.

When nine months old the colts are moved to a pasture away from their mothers and for the next eight months they do little but grow and play. Twice a day, however, one of the trainers keeps up the routine of petting them to keep them gentle and now he begins to pay special attention to their health. The grazing colts are quite playful and are apt to get cuts and scratches from rolling on the ground or from the hoofs of other colts. Each scratch is healed under the eyes of the rancho veterinary.

The real schooling of the colts starts the July following the year when they were born, when they are about eighteen months old. By now they have ended their period of fast growing. Each is placed in a separate box stall and is left there for about a week to grow accustomed to being confined. While the colt is in the stall the veterinary examines its teeth and files down any sharp edges that might cut the mouth in eating. Then the colt gets a manicure. Each hoof is leveled off and fast-



growing parts are pared down so that he can run properly. The horses are not shod at the rancho but are left barefooted until they are ready for their racing careers. While they are still in their stalls their manes and tails are thinned out with sharp combs to improve their appearance. For a couple of hours each day the colts wear an ordinary halter just to get them used to the harness.

At this time, also, Dr. E. J. Foreman, the rancho veterinary, makes a thorough examination of each colt and gives him a course of treatments and medicines that puts him in tip-top shape. Just like humans, high-strung race horses are susceptible to many diseases. Part of Dr. Foreman's job is to look over every horse in the school each day for the first signs of sickness. Lots of sunshine is one of the best safeguards



© Carroll Photo Service (Top picture)

*Top, Kentucky Derby winner decorated with wreath.
Below, colt learns to make friends with humans*

against influenza and pneumonia. Electric fly traps are installed in the buildings, stalls are disinfected every morning and are raked out each hour. Every few days the barns are given a major cleaning and the walls and ceilings of the stalls are sprayed with antiseptic solution.

After this treatment the colts are ready for their first lessons from the lead pony.

(Continued to page 138A)

Bottom, trainer on lead pony teaching nervous colt to stand quietly in starting gate

Joins of Wallboard Hidden by Cement and Tape



Slapping cement over recessed joint, workman applies fibrous tape and then smooths cement over it

Wallboard so designed that its joints can be concealed by tape and cement is being introduced to the building industry this year. The edges of the face side of this fire-resistant board are recessed so that, when two boards are erected together, there is a shallow channel at the joint. Special cement is applied along this channel and a strong, fibrous tape is imbedded in the cement, which is then smoothed off leaving an even surface, unbroken by joints or shadows and ready for decorating.

Super-Speed Lens Traps Rays Sent by Star in Dinosaur Era

Light rays that left distant stars in the days before earth's dinosaurs are being photographed with a new super-fast lens used in conjunction with the hundred-inch telescope at Mt. Wilson observatory. This astrographic lens is six and one-half times as fast as the f.1.5 lenses mounted in the speediest "candid" cameras. The big re-

flector on Mt. Wilson gathers up light that started for the earth while the Appalachian mountains were forming; concentrates it on the speed lens which "writes" a record of the light as a streak the size of a pin-head on a photographic plate. It takes a sixty-hour exposure to catch this streak on the plate. Until the fast lens was used it took twice as long.

Scent Added to Shower Bath from Salt-Filled Magazine

Those who like scented baths can now have a scented shower. A metal magazine installed just above the spray contains a supply of bath salts, and as the water flows through the crystals it takes on a delicate scent.



Acid Test for Auto Headlamps Checks Reflector's Silver

Surface coating of reflectors in the headlamps of one low-priced automobile is a layer of pure silver. To make sure that this layer is up to specifications, chemists strip it off the reflector with nitro-sulphuric acid. Then it is precipitated, filtered, dried and weighed to determine the exact quantity of silver removed.



Removing the silver from auto headlamp in Plymouth factory to determine its weight

Plymouth Corp.
341 Massachusetts

United States Engineering Co.
300 W. Adams St. Chicago

Raynor Astrographs

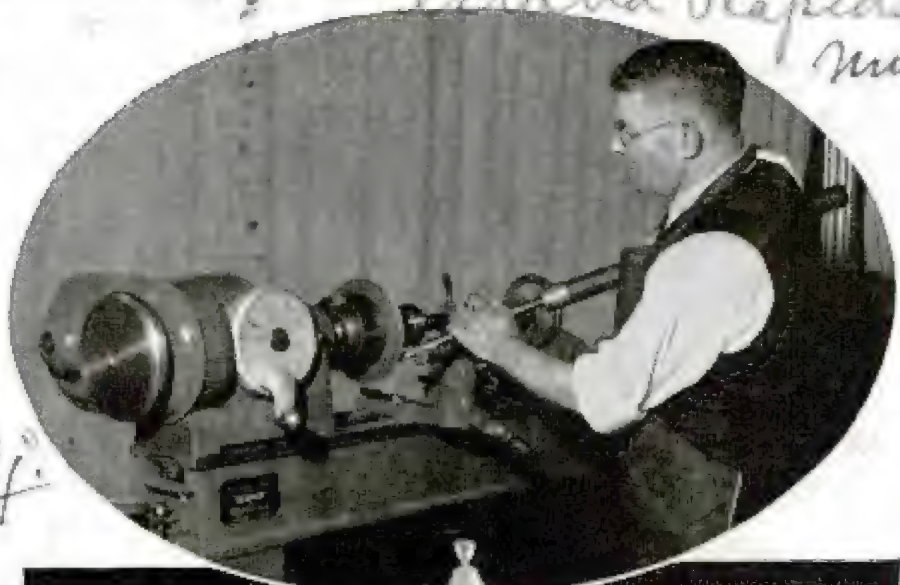
Designed by Dr. Wilbur
D. Raynor, director.

Rockwell Co.
Danbury and Long Island City

35 Madison Ave.
New York
clerk. m. f. a. Belmont
37/30
ab. new York

Spinning Lathe Turns Wood or Metal Articles

For the home workshop or for industry, a spinning lathe has been developed which will turn out either metal or wood articles. Household pieces of metal can be cut easily, and in industry it is used to turn samples prior to die making or when the quantity to be produced does not warrant the expense of die making.



Elastic Boot Laces Give Added Comfort

Elastic laces for field boots have been introduced as a means of increasing comfort for the wearer and for making the boots easy to pull on and off. The laces consist of brown, silk-covered elastic. One end is tied, with the other end passing through the eyelet from the under side to conceal the knot. It is passed horizontally between each pair of eyelets, thus avoiding criss-cross lacing and improving appearance. At the top the lace is pulled through several eyelets, creating tension, and an end is tied. When the knot is released, it is in position out of sight. Not disturbed when the boots are put on. One yard of the lace is for one pair of boots.



Top, at work on the spinning lathe which can fashion articles of either metal or wood. Below are some of its products, both decorative and useful

Metal Seat Clamps on Bike for Extra Passenger

Designed for attachment to top bar or handle bar of a bicycle, a handy metal seat is available for an extra rider. Its use eliminates seating the passenger on the cross bar and the accompanying danger of accidents caused by feet becoming entangled in the wheel. Four vents in the seat form an air cushion to make it more comfortable. It is available in colors or in chromium-plate to match trimmings on the bicycle. The seat is also useful for carrying extra luggage.



79 cents

NO-TIE ELASTIC CO.
No. 1606 Yellow



Three views of boot laces made of rubber. These laces give increased comfort

The Shoe-Laster Co.
New York City

W. J. Shag and Associates
Chicago

Pat. # 1970152
Left this address.
Mr. Jack S. Langley, Box 15, Consock, Ky.

W. J. Shag and Associates
Chicago

Whitewash Applied Before Tar Makes Brick Street Nonskid



Whitewashing bricks before tarring crevices makes it easier to remove excess tar from surface

To prevent cars from skidding on soft tar and to save the tar itself, engineers conceived the idea of whitewashing the bricks when they laid a highway through Omaha. After the brick was laid and rolled, ordinary whitewash was sprayed from a portable tank with self-contained pump. As soon as it dried, hot tar was poured to fill the crevices; then, while the tar was still soft, workmen scraped the top of the bricks with wooden hoes. The whitewash prevented the tar from sticking to the tops of the bricks, and the scrapers rolled the excess tar along to be gathered in piles and returned to the melting pot.

Wool Is Made Unshrinkable by Dipping in Chemical

Without affecting its durability, original softness, fluffiness and color, wool can be made unshrinkable by dipping it in a solution containing sulphuryl chloride. The chemical is dissolved in white spirit, a solvent used in dry cleaning, in a one and one-half to two per cent solution. The

treatment lasts about an hour. Dipping the wool into the solution causes it to shrink without damage and thereafter there is no shrinkage. Wool can be treated as it comes from the sheep's back or after being made into clothing. There is no necessity for washing it before the treatment. Wool mixed with rayon and cotton can be treated without harming these fibers, provided they are not too damp. Unshrinkable processes for wool have been used for about forty years, but all of them contained at least one disadvantage, causing some form of damage.

Frost Is Banished from Orchard by Oscillating Air Heater

Ten acres of orchard can be protected from the menace of frost by a hot-air heater just developed. It has a rotating blower unit mounted on a standard thirty feet high and will oscillate to send warm air over any desired area of the orchard. The hot air is shot up the flue to the blower from a smokeless oil-burning boiler on the ground. This heater was designed especially for the citrus belt.



Hot air from boiler at base is shot up thirty-foot stack and blown over orchard by oscillating fan

Federal highway, built by U.S.A.

Adam S. 954
Birmingham

diminution plant.

and. lo. W. L. 1945

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Gas Masks Made Useless by New Chemical

Discovery of a chemical compound which destroys the soda-lime element in gas masks, rendering them useless, has been reported by an Iowa state college student. Destruction of the element would permit the acid in poison gases to pass through the carbon filters and into the lungs of the wearer, causing serious injury or death. Phosgene and mustard gas, two poisons used in the world war, and a third element, which is being kept secret, are used in the compound. It is understood that the mixture can be manufactured cheaply from the waste products of copper and zinc smelters, common salt and oil-refinery waste. The compound may make obsolete every gas mask now in use and chemists may be forced to find another element which can withstand the attack of the chemical and prevent poison-gas acids from passing. Many nations are equipping civilians, as well as the military, with gas masks

and are conducting anti-air raid exercises to teach proper use of masks in wartime.



© Planet News, Ltd.

Soldiers equipped with gas masks are shown in practice rescue work. The next war might well duplicate conditions in this picture

Unsinkable Raft with Motor Attains Moderate Speed



This raft on pontoons is handy for water sports. Propelled by outboard motor, it attains a speed of seven miles an hour

Fitted with a motor which propels it at a rate of seven miles per hour, an odd raft has made its appearance on Lake Erie. It is said to be unsinkable and capsized-proof. The owner finds it an excellent means of going fishing and of reaching deep water for diving and swimming.

Inquiries as to makers of articles described in Popular Mechanics will be answered by our Bureau of Information upon receipt of return postage.

Justice Leonard
L. Stewart, Kalamazoo, Mich

newspaper City
say no definite results.



photographer. Victor Milner

boy makes

MAKING MOVIES TRUE



Top, scene from "The General Died at Dawn." The boat is a reproduction of Chinese junk. Bottom, expert rehearses actor in proper way to hold sextant

WHEN the telephone rings in the research department of Paramount studio in Hollywood, Gladys Percey never knows what strange new questions some director or writer is going to ask her

"What?" she replies. "How many buttons were there on a 1912 shoe? Was Napoleon left or right-handed? And you want a picture of a Civil War lead pencil? All right, I'll call you right back."

When she returns the call she has the answers right in front of her, dug out of a library of 7,000 volumes and tens of thousands of magazines and clippings gathered from all parts of the world. In this reference library the research staff can find the answers to practically any question you could ask. Through the index you can locate anything from a picture of sandals worn by a Roman soldier right down to the appearance of a modern Shanghai ricksha license plate.

Motion picture studios are going to great expense to make sure that their pictures are correct in every detail. Films must be

10555 Holman Ave.
Los Angeles Calif.



TO LIFE

historically accurate no matter where or in what year the scene is laid. Even the gestures made by an actor must be right. It would never do, for example, to show an Arab mounting his camel in the wrong way. Before such a picture is made the actor must be taught to mount the camel in the proper way.

Few people are familiar with early Anglo-Saxon table manners yet when such a scene is planned the research department checks up on all the details. Otherwise some one might point out in a letter to the studio that modern forks or some other eating implement didn't exist at that time. A crude cast iron water pump that might be correct for an early American picture has no place in a scene showing a modern Chinese village where water pumps made of bamboo are still used. Evergreens would be a sad mistake in a picture laid in Egypt, and common tropical flowers have no place in a picture of the highlands of Peru.

In filming "Ebb Tide," a color picture



Top, left, realistic dragon. Right, repairing flintlock pistol; building cardboard town; Gladys Percey looking over pictures of early uniforms, and, inspecting properties built with aid of research department

References: Oberb. Hollywood. Publishing Dept. Paramount Pict. Co. 13111 Marathon St. Los Angeles Calif.

Paramount
707



© Paramount News

Left, antique guns are cheaper to buy than to imitate, so Paramount's gun room contains thousands of dollars worth of old weapons. Right, old sailing ship which may be re-rigged several times a year for pictures laid in different periods

laid in the Pacific in 1890, the Paramount research department not only had to investigate the types of sailing ships of the time and the appearance of typical South Sea island villages, but even had to trace the kind of boxes used for shipping California champagne, how the boxes were stowed in the hold of a ship, and the details of a French colonial flag-lowering ceremony. Rigging on the ships had to be authentic so that in close-up pictures no gear that has been invented since would be shown. In one scene the director planned to use a yellow quarantine flag to show that there was sickness on board a ship. Then it was discovered that a black and yellow flag instead of a plain yellow one is the proper signal. Additional research, however, disclosed that the modern black and yellow flag was adopted in 1897 and that the yellow flag was correct before that year. The yellow flag was used after all, but not until research showed that it was correct.

In another marine picture the research staff had to provide material for sets showing Liverpool and its shipping as it appeared in 1840. The uniforms of the

English marines of the period, how they drilled, whether seamen wore beards then, what they ate, and the price and appearance of steerage tickets all had to be traced down. At first it was planned to dress the seamen in ordinary oil skins for a storm scene, but the research staff discovered that oil skins hadn't been invented then and that instead seamen wore heavy canvas raincoats that they made out of spare sail cloth.

When a scene calls for an actor dressed in seafaring garb to plot the position of his ship on a chart he is carefully rehearsed by a technical expert who tells him just how to use the parallel rulers and dividers. If he is to "shoot the sun" with a sextant the technical advisor stands at his shoulder during rehearsals and shows him how to hold the instrument. If an accident in the rigging is to be filmed the expert is on hand to direct the actors so that the scene won't look faked to someone who has been to sea. Realism in every scene is the goal of Hollywood.

The technical experts supplement the work of the research department and each of them is an authority in his line. There



are about eighteen such experts in Hollywood and among them are men who have lived in every corner of the world. One is an authority on Japanese life, another knows practically everything about Egypt and Arabia, while a third may be an expert on old and modern Russia. Lots of experience and a perfect memory are two of the qualifications for such a job. Each expert is continually doing additional research in his special field.

"A technical advisor is not only an expert in his subject but he must be familiar with all the little mannerisms and habits that make up local color," explains Capt. C. F. Cook, who has been advising on marine and tropical life for seventeen years in Hollywood. "For example, it would never do to have a deep-sea fisherman merely glance at an aneroid barometer to see if a storm is coming. To be true to life the actor should tap it a time or two just as real seamen do to make sure that the needle points properly. And he never calls it a 'barometer' but a 'glass.' The 'glass' is the common seafaring term for the full

(Continued to page 114A)

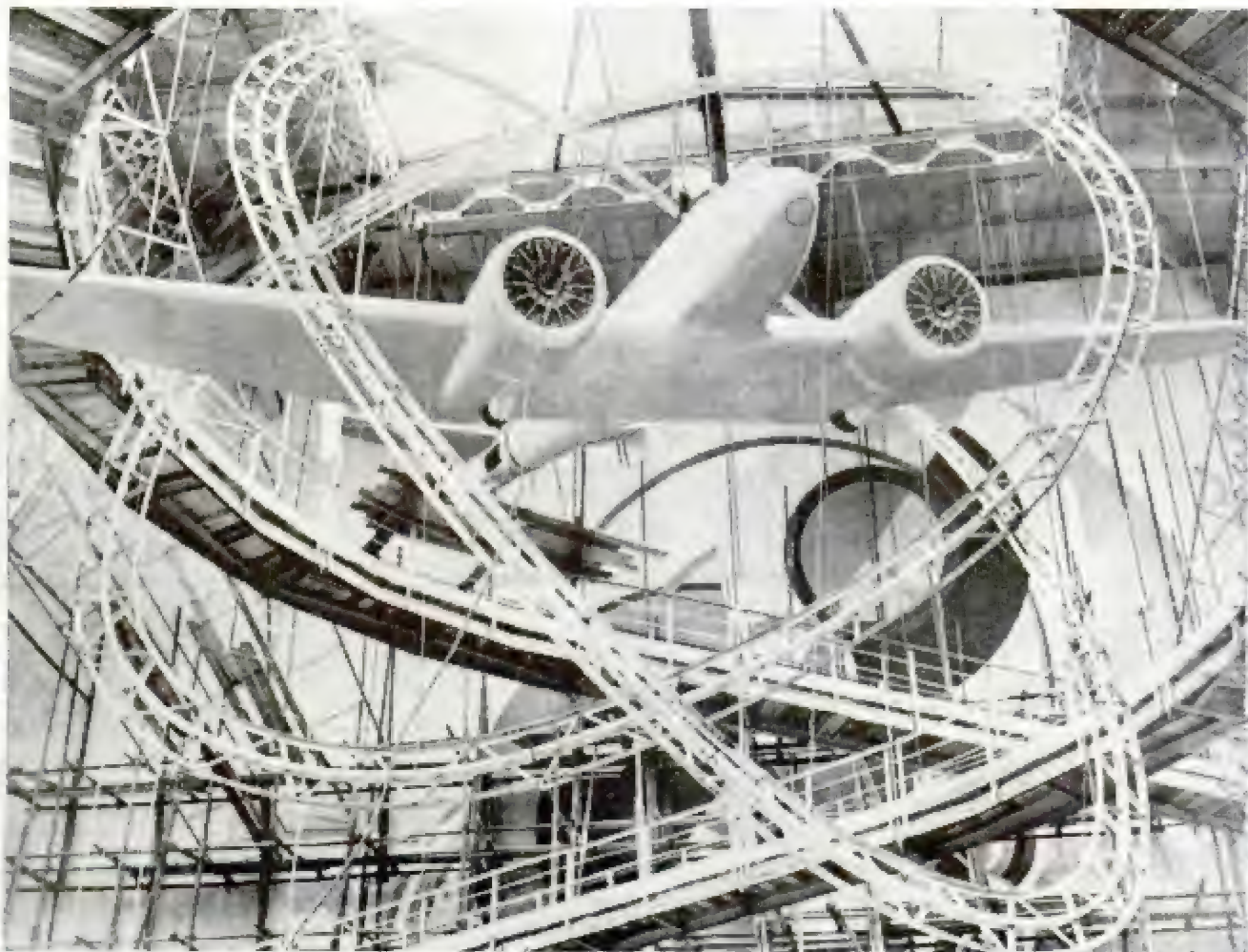


Top, left, checking design of coat-of-arms. Right, horse and rider in medieval armor made from research pictures; antique five-burreled flintlock, and, Liverpool waterfront of 1841, as constructed for "Souls at Sea"

Paramount Henry Cooper
Leaves Best

Barber, Star of Finland
Scheer, Pacific Queen
To the Bennett
Hammari
The Caron

Exhibit Symbolizes Globe-Circling Flights

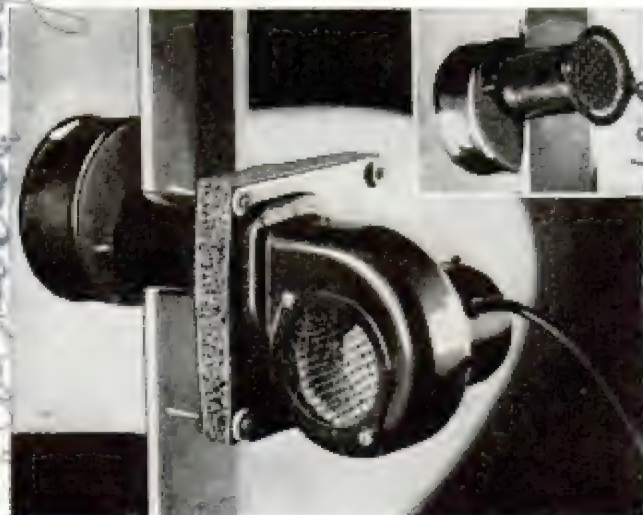


Symbolic of aviation's conquest of the globe is this unusual exhibit at the Paris exposition. Note the runway on which spectators may walk as they view the exhibit from every angle.

An unusual display at the great exposition at Paris, France, is intended to symbolize aviation's conquest of the world.

The central figure is an airplane, with large loops and circles about it, symbolic of long-distance flying in all directions.

Photo Darkroom Ventilator Has Light-Trapped Tubes



Intake and outlet of this ventilator are light-trapped. It keeps fresh air circulating in darkroom.

Fresh air for the photographer's darkroom can be supplied by a noiseless ventilating unit with light-trapped intake and outlet tubes. Each opening is two and five-eighths inches in diameter, the fan unit on the outer wall pushing air through a fiber tube into the room. Its capacity is thirty-five cubic feet of air per minute.

Earth's Varying Speed Gauged by Quartz Chronometer

Since the quartz chronometer was perfected three years ago, enabling man to measure time with almost absolute accuracy, the Reich Institute of Physics in Ber-

lin has studied the time it takes the earth to revolve on its own axis. During a thirty-day investigation the earth's speed increased slightly. The investigators point out the importance of these variations. If, for example, on May 2, 1934, the earth "slowed up" by .25 second, that means that a given point on the equator would have been 115 meters (approximately 377 feet) westward of where it would have been if the speed of the earth's revolutions were uniform. Calculations indicate there are fluctuations in the earth's speed, but that these fluctuations are probably all contained within a given solar year.

Class in Woodworking Art Shows Skill as Craftsmen



Here are some examples of the work of a woodworking class conducted by a municipal department in Chicago. The work is exceptionally good

Fleet of "Cockroach" Sweepers Cleans Both Walk and Street

So light that they can be used to clean the sidewalks as well as streets, a fleet of sweepers has been shipped to a Buenos Aires, Argentina, suburb by a Cleveland manufacturer. The Argentines have nicknamed these busy little sweepers "Cucaracha," or "cockroach." All the controls are inside the cab. The five-foot broom



Nicknamed "Cucaracha," this sweeper is light enough to run on the sidewalks of a Buenos Aires suburb

rotates at eight speeds, and the car itself has four speeds and can turn in a seventy-eight inch radius.

Under the guidance of expert instructors, youthful pupils in Chicago's municipal craftsmanship classes are becoming proficient. Classes are producing excellent results, particularly in the art of working with wood. Finished articles reflect skill in wood burning and wood carving.

Automatic Step for Trailers Unfolds When Door Opens

Arranged to slide into place when the door is opened, an automatic step for trailers is on the market. When the door is closed, the step slides out of sight under the trailer. It is constructed of durable rolled steel and is eight by fourteen inches.



Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

(Sues) General Tire and Rubber Co.

1022 Riverside Park
P.O. Box 2100
Kansas City, Mo.



HOUSEKEEPING



Air hostess, top, aiding mother with baby in comfortable sleeper berth. Below, dinner in the clouds is like dinner in a fine restaurant

AS THE sun drops into the west you lean back in your seat on the TWA "Skysleeper Chief." Since leaving Newark late in the afternoon you have been watching the scenery below. Now you begin to feel hungry. Then you turn at a question from the hostess.

"Would you like your dinner now, sir?"

A moment later she is back with a sturdy table that snaps into the wall and while you watch she deftly sets your place. Gleaming silverware, linen, china plates and tempting hot food appear almost by magic. Here in the clouds, flying across the continent at 200 miles per hour, you eat a tasty meal served piping hot that is as good as any fine restaurant can offer. Next morning, crossing over the Colorado river into California,



in the CLOUDS

you may have breakfast served in bed if you like. Yet if you peer into the "kitchen" over which the hostess presides, you will find no stove and hardly any other equipment.

Behind this luxury of dining at your ease in the clouds is an efficient, unseen organization on the ground. In her job of keeping house in the air the stewardess has plenty to do besides cook for seventeen hungry passengers, so TWA transfers most of that work to the ground crew. Carried in pre-heated vacuum containers, the food served at dinner time was placed on the plane just before



Passengers leaving a "skysleeper" at end of a transcontinental trip and, below, whiling away time in one of the berth compartments of a sleeper plane



meal are kept. Usually two jugs are filled with some such meat as baked ham while each of the others contains a cooked vegetable. Standing in her small compartment, everything she needs for serving meals is within reach. All she does is assemble the food on the plates and serve it.

Feeding the flying public is really a big business

it left Newark. Breakfast came on board at Albuquerque before you got up.

A year or so ago airplane passengers ate cold sandwiches out of a box and drank tepid coffee in a paper cup. To bring that kind of service up to date took lots of careful planning. Space on the planes is limited, weight must always be considered.

Part of the result is an ingenious group of cabinet drawers in which the table service and part of the food for each meal is placed aboard the plane. The boxes are freshly filled in the commissary department just before a plane leaves, and slide into shelves of a cabinet in the galley. Knives, spoons, and other silverware go into one drawer; linen, crackers, and other small items go into another. The "cold box," a miniature lightweight ice box cooled by Dry Ice, contains salads, frozen desserts, and other foods to be kept cool. The stewardess can reach anything she wants by sliding out drawers of the cabinet.

A rack in the galley supports eight two-quart vacuum bottles filled with hot water for making tea, bouillon, and other hot drinks. By means of special faucet-type heads the hostess can draw liquid from any bottle without supporting it in her hands. Another rack holds two one-gallon vacuum jugs filled with drinking water. In the galley also is a steam-table compartment kept hot with water warmed by exhaust gases where the four large vacuum jugs that contain the main course of the



Top, preparing meal in plane's galley. Below, vacuum jug in which food is carried

today. Eight restaurants along TWA's transcontinental route prepare the food. Hauling about 10,000 passengers per month, the line spends as much as \$100,000 per year on food alone. An individual dinner served free to a passenger costs ninety cents and a lunch costs about seventy-five cents, delivered to the plane.

In a year, one line serves fifty tons of fried chicken and more than twenty-five tons of chops, ham, and cold cuts. Added to these are other tons of assorted vegetables, fruits and bread. Half a million cubes of sugar are stirred into coffee cups in the air every year. Last year one air line alone served 190,000 meals aloft.

The food you eat in the air is no hit-or-



Stewardess, left, making up the berths in a "skysleeper" plane. Below, a typewriter is one of the conveniences found aboard the modern air liner. Bottom, magazines and extra blankets are stowed away in overhead shelves above the seats

miss assortment but is carefully selected according to a planned menu that is changed every day. Planning the meals is the job of the line's dietician, who chooses dishes which agree with you at high altitude and which may be carried in vacuum containers and still retain their freshness. Chicken is a favorite meat. Usually the menu is arranged to include dishes typical of the section the plane is flying over. Kansas City steaks are served in the middlewest, fresh trout for breakfast is an Arizona item, and avocado salads are part of a lunch or dinner in the southwest.

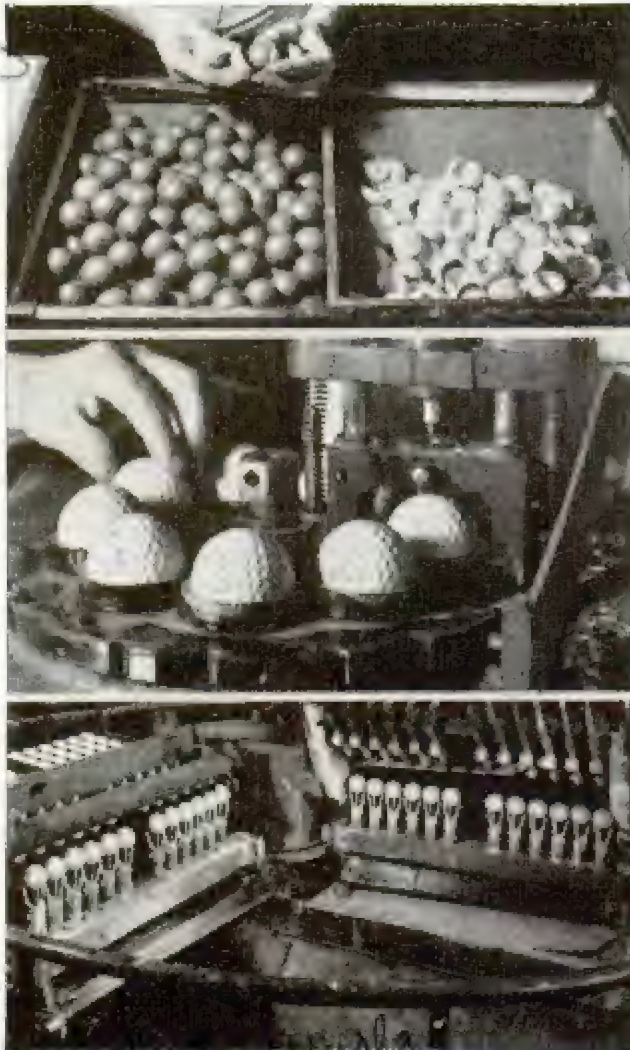
Serving meals is only part of the hostess' job. When you get sleepy the hostess prepares your bed with a few efficient motions. Each pair of seats in a sleeper or in the sleeping compartments of a combination plane convert into comfortable upper and lower berths resembling railroad sleeper accommodations. Each berth has its own window, electric light and ventilation, and contains a thick, comfortable lightweight mattress, mattress cover, sheets and blankets and pillow.

Sleeping in the clouds is no longer a makeshift arrangement. Berths are six feet and four inches long and more than a



(Continued to page 120A)

Rough Face Smooths Flight of Your Golf Ball



Top, putting cover on core; middle, needling, and bottom, spraying durable white paint on golf balls

Those dimples on the face of your golf ball are not there as beauty marks. The rough cover is what makes the ball fly straight, and a "shot in the arm" is the latest trick of the manufacturers to make the ball fly farther. The first golf balls were smooth-surfaced, and they soared and dipped and curved like a wounded bird. Players found that old, scarred balls drove straighter, and then the manufacturers began dimpling the balls. Today the very shape and number of the markings on the little white pellet are figured out scientifically for the ultimate in straight shooting. After the rubber core is wound tightly, two tough shells are placed over it and laid in a mold for vulcanizing. Given its characteristic dimple marks, the ball is fed under a needling machine. A hypodermic needle forces liquid under high pressure

into the core center, expanding the rubber winding and thus giving added distance to your stroke. After receiving this "shot in the arm" the ball must conform to required size and weight, and if it fails to meet the standard a red light flashes and the ball is withdrawn. Finally it is painted. Each ball rests on three tiny prongs set on a revolving arm which brings the row of balls under paint sprayers, the balls rotating while the spray is applied. Then they are dropped into a tray to dry. The special paint used is tough, flexible, and does not flake or mar easily.

Robot Signalman Rides the Sky Gathering Weather Data

Working without pay, a corps of balloonists is riding the sky making expert observations of winds, temperature and barometric pressure for the weather bureau. These balloonists—expert radio operators and scientific weather men as well—are robots, packed in a small box attached to a hydrogen-filled rubber balloon

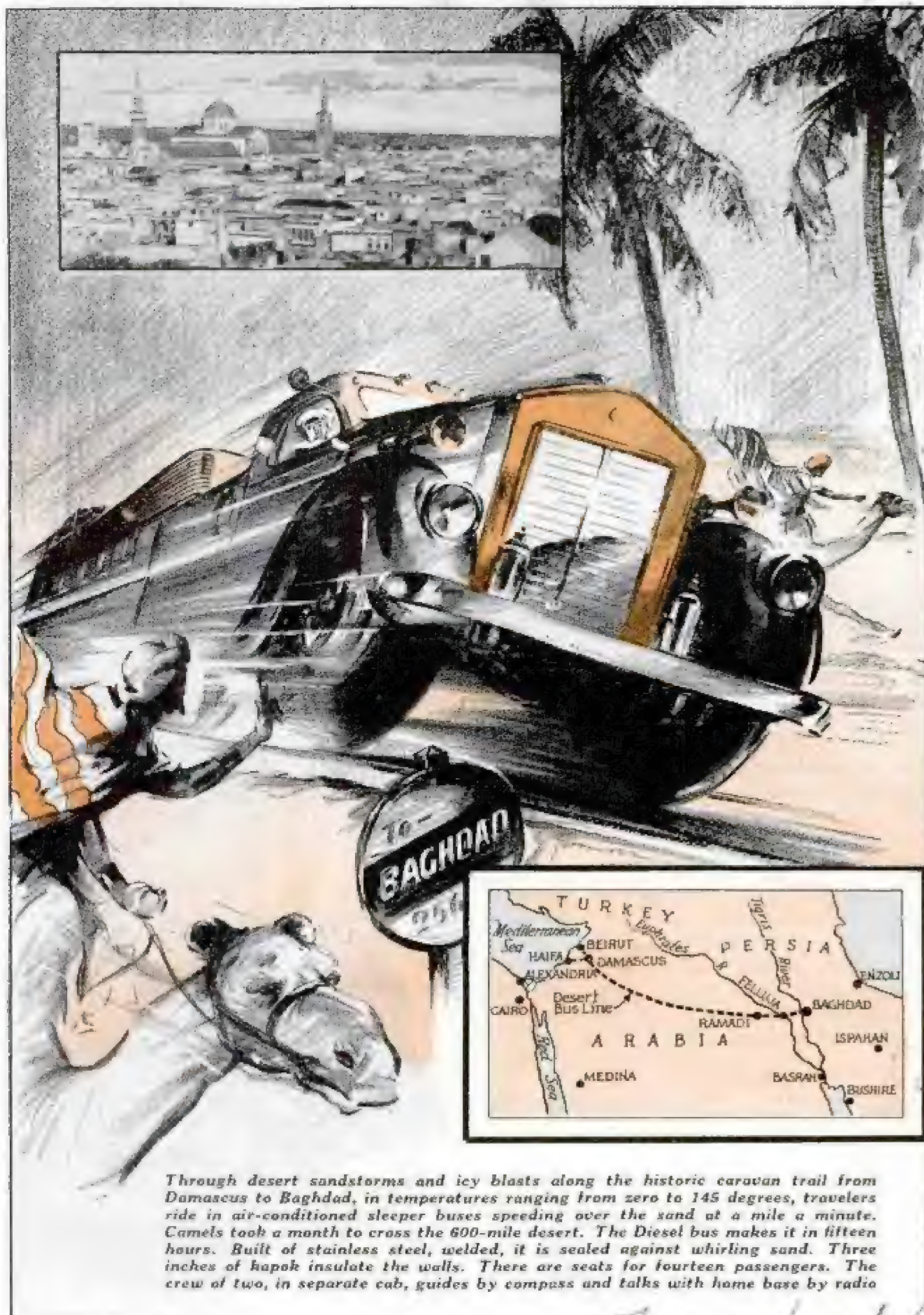


Releasing weather bureau balloon with instrument box attached. Inset shows the robot "observer"

set free at intervals from the principal observation points. In the box is a clock, which runs the mechanism; a two-tube radio set which automatically signals the observations taken by the other instruments, which include a thermometer, hygrometer, and barometer.

July 3, 1937

Mile-a-Minute Sleeper Bus Spans Syria Desert



Through desert sandstorms and icy blasts along the historic caravan trail from Damascus to Baghdad, in temperatures ranging from zero to 145 degrees, travelers ride in air-conditioned sleeper buses speeding over the sand at a mile a minute. Camels took a month to cross the 600-mile desert. The Diesel bus makes it in fifteen hours. Built of stainless steel, welded, it is sealed against whirling sand. Three inches of kapok insulate the walls. There are seats for fourteen passengers. The crew of two, in separate cab, guides by compass and talks with home base by radio

1937 July 3

Transport Co. Baghdad

8/4/37

Weather-Scarred Prison Ship on Tour as "Oldest Afloat"



Stern of the heavy-timbered prison ship "Success," built in 1790 and once sunk off Melbourne. It is now on exhibition tour

Her heavy timbers giving away her age, the ancient convict ship "Success," of Melbourne, Australia, is on exhibition tour as the "oldest ship afloat." The vessel was laid down at Moulmein, British India, in 1790 as a merchant ship but from 1802 to 1868 the British used it as a floating prison and it houses many of the primitive implements of torture to which felons were subjected. It was built of solid Burmese teakwood, its bow two and one-half feet thick. The "Success" once went to the bottom off Melbourne, Australia.

Italy Leads in Aviation Records with United States Second

In the last year Italy has risen from third to first place among the nations in the number of aviation records held. The United States topped the list a year ago with fifty-four records, while France was second with thirty-seven, Italy had twenty-six and Germany, Great Britain and

Russia trailed. Now Italy leads the world with forty-five flying records, the United States has forty-three, France thirty-five, Russia fifteen, Germany fourteen and Great Britain four. For a year Italy and Great Britain have alternated in pushing up the world's altitude mark, now held by an English flyer at 53,937 feet.

Owner May Restyle Car with Strips, Valances

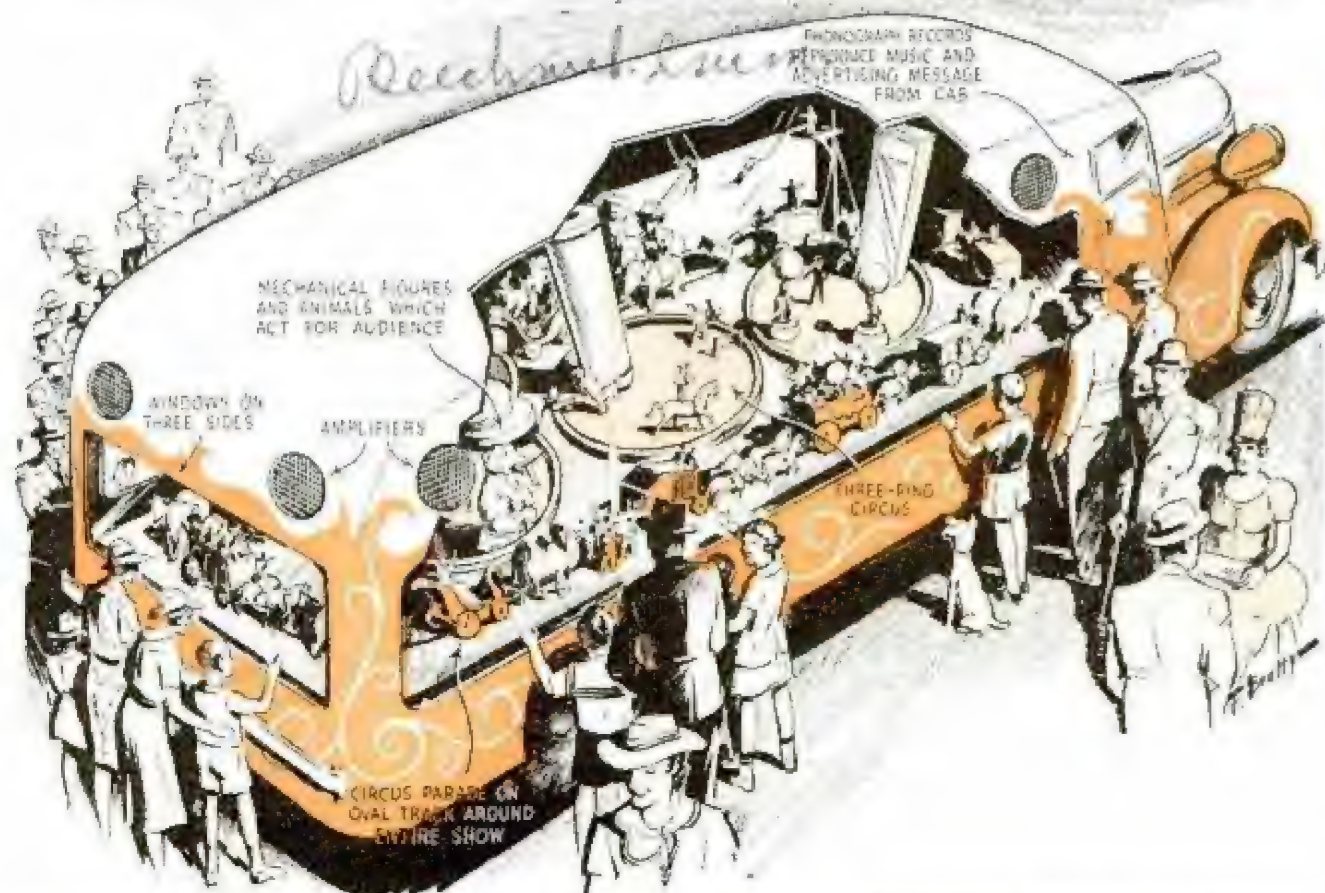
Designed to accentuate the sweeping lines of one of the low-priced automobiles, a combination of molding and beading is on the market. It consists of a streamline radiator grille, a series of raised molding strips which are carried back along the panels of the doors and sides of the car to end in a narrow graceful sweep at the rear, and an upper and lower beading of stainless steel. The intervening beads are finished in bone white and may be painted to suit the individual taste. The metal strips create an illusion of greater length. To enhance the streamline effect, a special valance of tear-drop form is employed to cover the upper portion of the rear wheels. A steel bumper bolted to the frame protects the valance. By repainting the beads in different colors and by using different combinations of molding, beading and wheel valance, the car can be restyled each year.



The owner may change appearance of this car by using a different trim

Metacraft Corp.
5191, Penrose Ave

Three-Ring Miniature Circus Staged in Truck



Here is the miniature circus entertaining a curbside audience. An endless parade marches around track while mechanical performers do stunts in rings. Music and advertising are carried by loudspeakers

Tiny bareback riders canter around the center ring while mechanical elephants and trained seals perform stunts in a curbside circus whose "big tent" is an automobile truck. Built for advertising purposes, it travels about staging its three-ring circus for street crowds. Folks gather around its broad windows and watch the endless

circus parade moving around an oval track surrounding the main rings. Trapeze performers swing from the roof, and while the show is on phonograph records played from the driver's cab offer an accompaniment of circus music interspersed with the advertising message, which is amplified and carried to the crowd by loudspeakers.

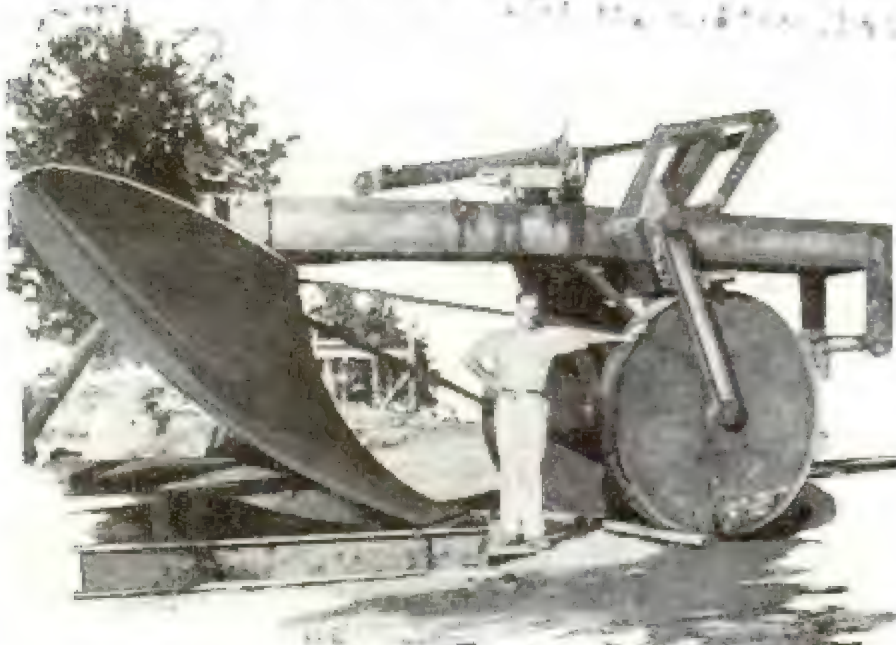
Sixty-Five-Inch Plane Tires Carry Fifteen Tons Each



Here is the giant airplane tire, pictured beside an automobile to show its size. It is one of the largest ever built

Each constructed to support a fifteen-ton load, giant tires are being placed on forty-passenger super-transport air liners nearing completion in a California factory. Two of the tires will be used on each ship to cushion the landings. Sixty-five inches in diameter and twenty-four inches across at the base, these tires are probably the largest ever built for regular service in this country. The tires weigh 360 pounds. Forty-five miles of cord and four miles of bead wire are used in each tire.

Giant Plow Cuts Six Feet Deep to Reach Rich Soil under Sand



Wade Watson
This big plow is capable of digging six-foot furrows. It was designed to uncover rich soil buried by sand when land was flooded

Designed to dig a furrow six feet deep, a giant plow will be used to uncover rich soil buried by sand deposited by the 1916 flood on the Santa Ana river in California. Two big Diesel-driven tractors will pull the plow. A powerful hoist noses the share into and pulls it from the ground. The moldboard, seven feet high, was fashioned from one piece of thick sheet steel.

Oil Supplies Still Seem Unlimited as Producing Methods Gain

Misgivings about the exhaustion of oil reserves are set at rest by J. Howard Pew, president of a leading petroleum company who points out that fresh discoveries of oil and improving methods of processing should quiet apprehension. Back in 1908 the petroleum supply was estimated between eight billion and twenty-two billion barrels, yet nearly the maximum of that estimate has since been produced and the supply still seems unlimited. As late as 1921 an authority put the remaining crude deposits at 9,150,000,000 barrels; production since has totaled 13,000,000,000 barrels and the proved reserves today are greater than in 1921. Early estimators, Mr. Pew says, could not foresee that wells

would reach a depth of two miles, that air-lift and gas-lift would increase the yield, that cracking methods would increase the percentage of gasoline obtained from crude oil sevenfold, and that hydrogenation would produce more than a barrel of gasoline from one barrel of petroleum. Mr. Pew adds that coal and oil-bearing shales could be drawn upon for "almost unlimited supplies" whenever demand and price justify it.

Policeman's Vest Reflects Lights of Autos

For protection of the policeman directing traffic, a new safety vest reflects automobile lights. The vest is studded with reflectors, which outline the policeman's figure when the lights of an approaching car strike them. This enables drivers to avoid striking him with their cars.



Light from the auto headlamps is reflected by this vest, protecting the officer

Police Dept. Budgetball Comm

Constructed at Bolina, Calif.

Compressed Air

July 1937

Belt - Traffic equipment

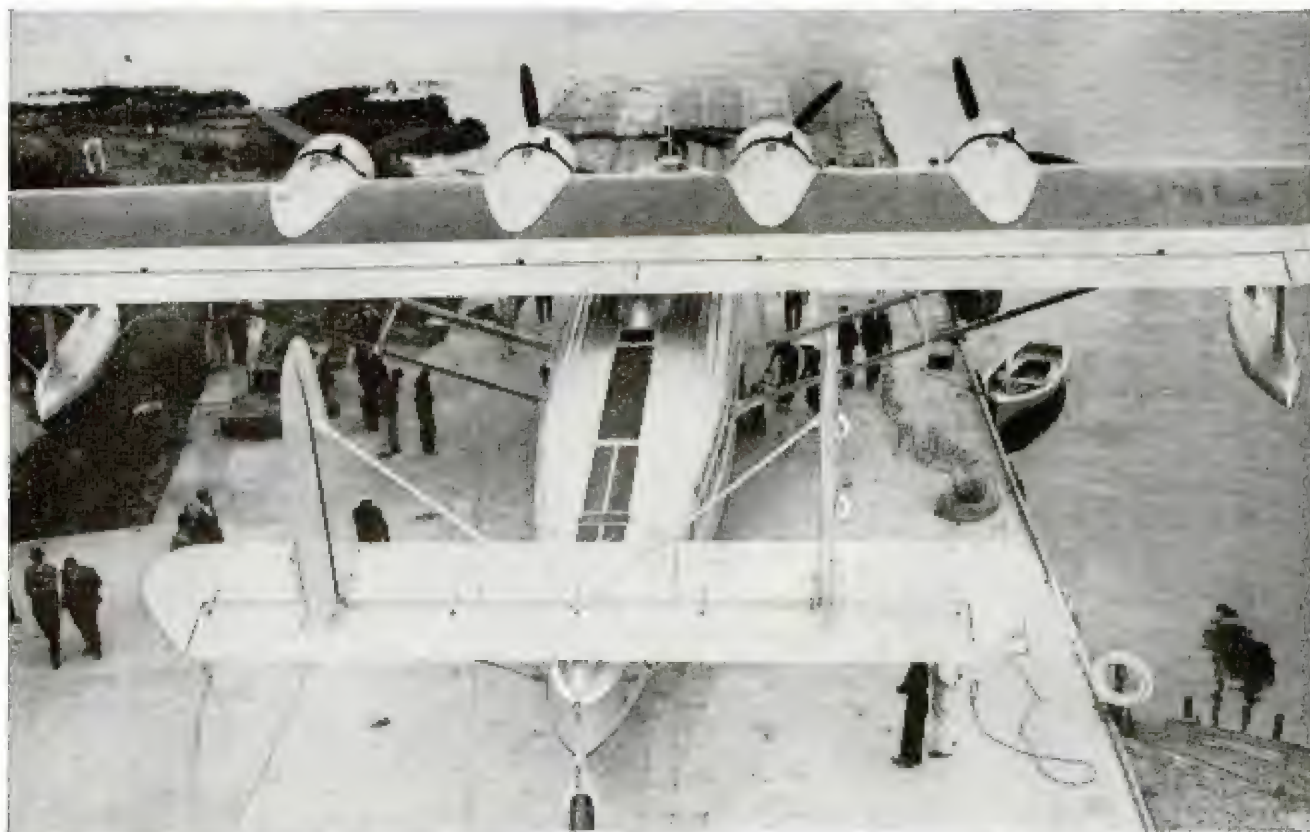
Acrylic Paint

Co. West

Manufactured

Photo

Sky Clipper Poises for Signal to Hop Ocean



© Planet News, Ltd.

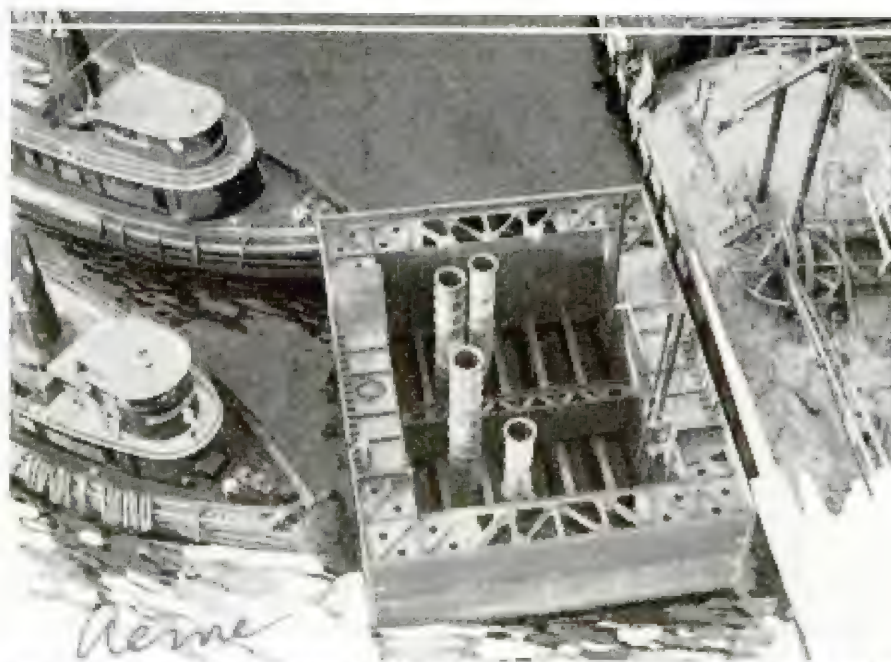
Flying clippers are usually seen in the air or floating in harbor, but here is the Atlantic Clipper on the ramp at Southampton, England, after its pioneering eastbound transatlantic flight

Some conception of the size of the Atlantic Clipper is afforded by this photograph of the flying boat, taken from above as it waited on the ramp at Southampton,

England, the signal for its return flight to America. After its pioneering eastward flight, the ship was overhauled and made ready for its westbound air voyage.

Caisson Is Sunk for Huge Tunnel under Hudson River

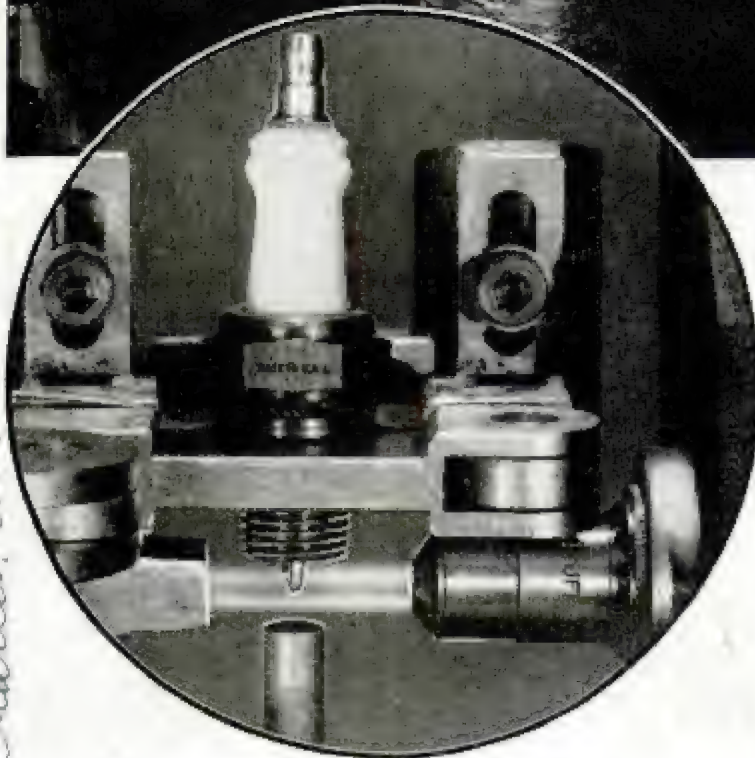
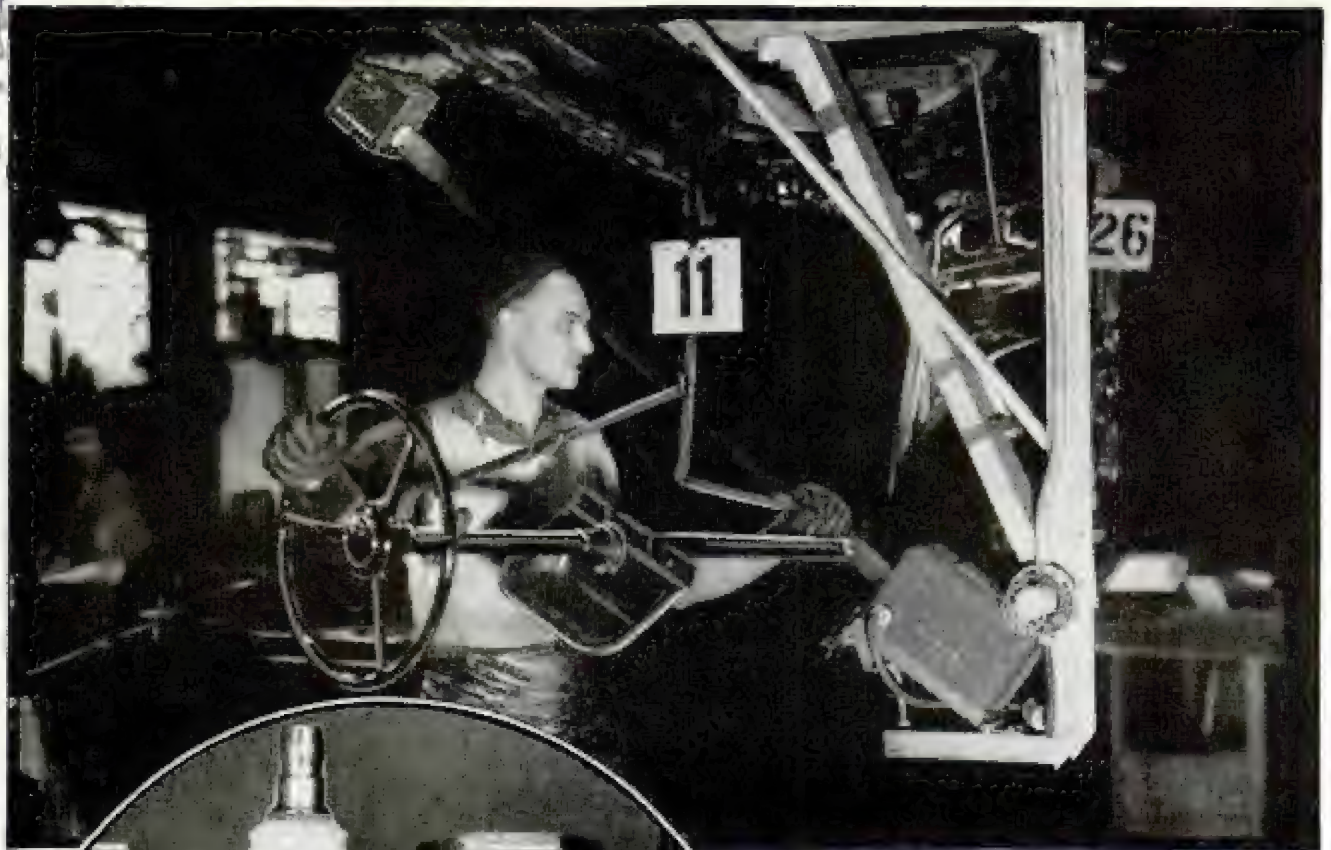
Work on the north tube of the new Lincoln tunnel under the Hudson river is under way, as a result of the recent sinking of a huge caisson near the bulkhead wall at the foot of one of New York's streets. The caisson was towed by two tugs to its location. It is fifty-two by forty-two feet wide and is thirty feet deep. The walls will be extended to 100 feet as work progresses. The construction is of steel skins inside and outside, with a steel wall to reinforce the concrete in the tube proper.



Tugs are shown completing job of towing and pushing caisson in place for start of work on tunnel. The caisson is thirty feet deep

es 688

The EYE that



Top, light beam projected from source above operator's head to photoelectric unit on the lower bracket stops the supply conveyor if the operator fails to remove steering gear assembly. Bottom, spark plug in clamp ready for light beam gapping. When the adjustable electrode of plug is bent into path of light by vibrating hammer, this shuts off light from photocell unit, automatically stopping the hammer

but it was not until sound-on-film pictures came to the theaters less than ten years ago that a commercially reliable photoelectric cell was developed.

Today electric eyes look with wearless, frictionless beams of light at rollers for bearings, automatically rejecting those with

"ELECTRIC eyes" are doing more than 500 different things which contribute to your comfort and safety. Speeding up production, insuring more uniform products, offering security and cutting costs are but a few of the problems solved by the photoelectric cell, and its necessary associated equipment.

Fortune, luck and science gave industry the photoelectric cell over forty years ago,

cracks and flaws too small to see with the unaided human eye. An automatic machine for grading, measuring and sorting is the result, with a definite saving in time and a more uniform product because the human element has been removed. Human eyes are saved, production is increased. These same electric eyes measure diameters of piston pins for motors with an accuracy of .0001 inch.

6th and
Proquire
St. Charles, Ill.
Electronic Control Corp.
2532 E. Grand Blvd. Detroit
Michigan

*Comb. Chrysler U.S. & Canada
Chief Engineers Electric
Control Corp.*

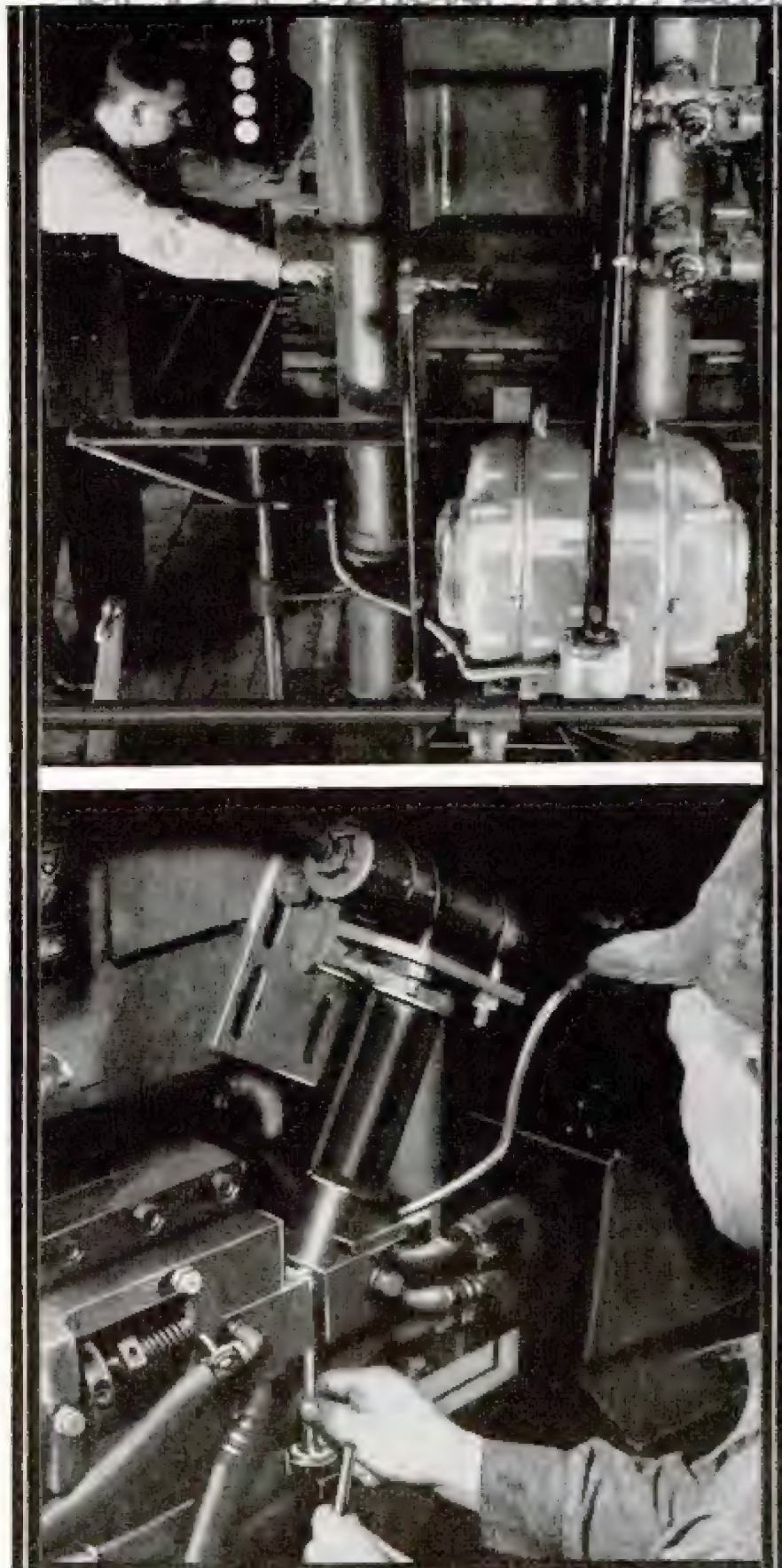
NEVER SLEEPS

2832-8 Grand Blvd. Detroit

Simple beams of light with electric eyes control automobile production. For instance, they eliminate the possibility of car bodies falling from the end of conveyors if they are not picked up for location on the chassis by an overhead crane at a desired point. Other electric eyes with their actuating beams count automobile parts as they pass through the light beam. Greater accuracy, without wearing mechanical arms or counter tripping devices, is the result.

To insure a better color match between automobile mudguards, splash pans and bodies, all painted with the same color, electric eyes are employed to replace the ever-changing human eye. The color sample is illuminated and light is reflected from its surface to a photoelectric cell whose feeble currents actuate a calibrated meter. Lighter shades reflect more light to the electric eye and are indicated as "lighter," while darker shades of the same color reflect less light and the meter's indicator falls to a lower point showing "darker."

When greater care in color control is essential, color filters are introduced between the sample and the electric eye. A reading is taken with each filter of the three primary colors in place and the percentage of color difference passing



Top, "curtain of light" near operator's left hand protects him by stopping the press. Bottom, electric eye controls valve stem heater



Operator placing kingpin between clamping dies of heater. The tubular housing, arranged to look at the heated section, contains the electric eye which turns off the current when the kingpin reaches the correct temperature. The dies automatically open, allowing the kingpin to drop into the gravity feed trough to a cooling fluid

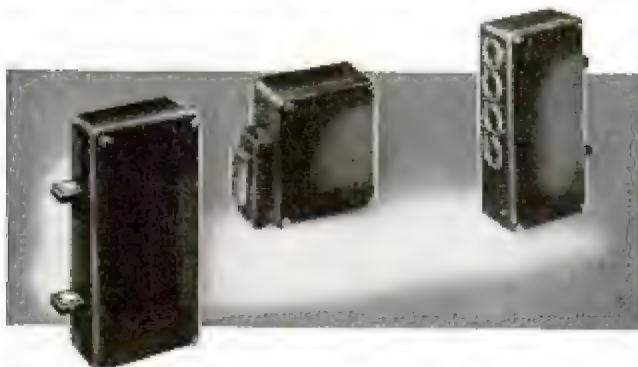
through the filters is calculated. As a result a better match is obtained.

Results accomplished in visible color control make possible temperature control. A section of steel rod heated in a furnace radiates a certain color, depending upon its temperature. The electric eye and its amplifier can be adjusted so a magnetic switch in the amplifying unit will cut off the heat when the rod reaches the color of the temperature desired.

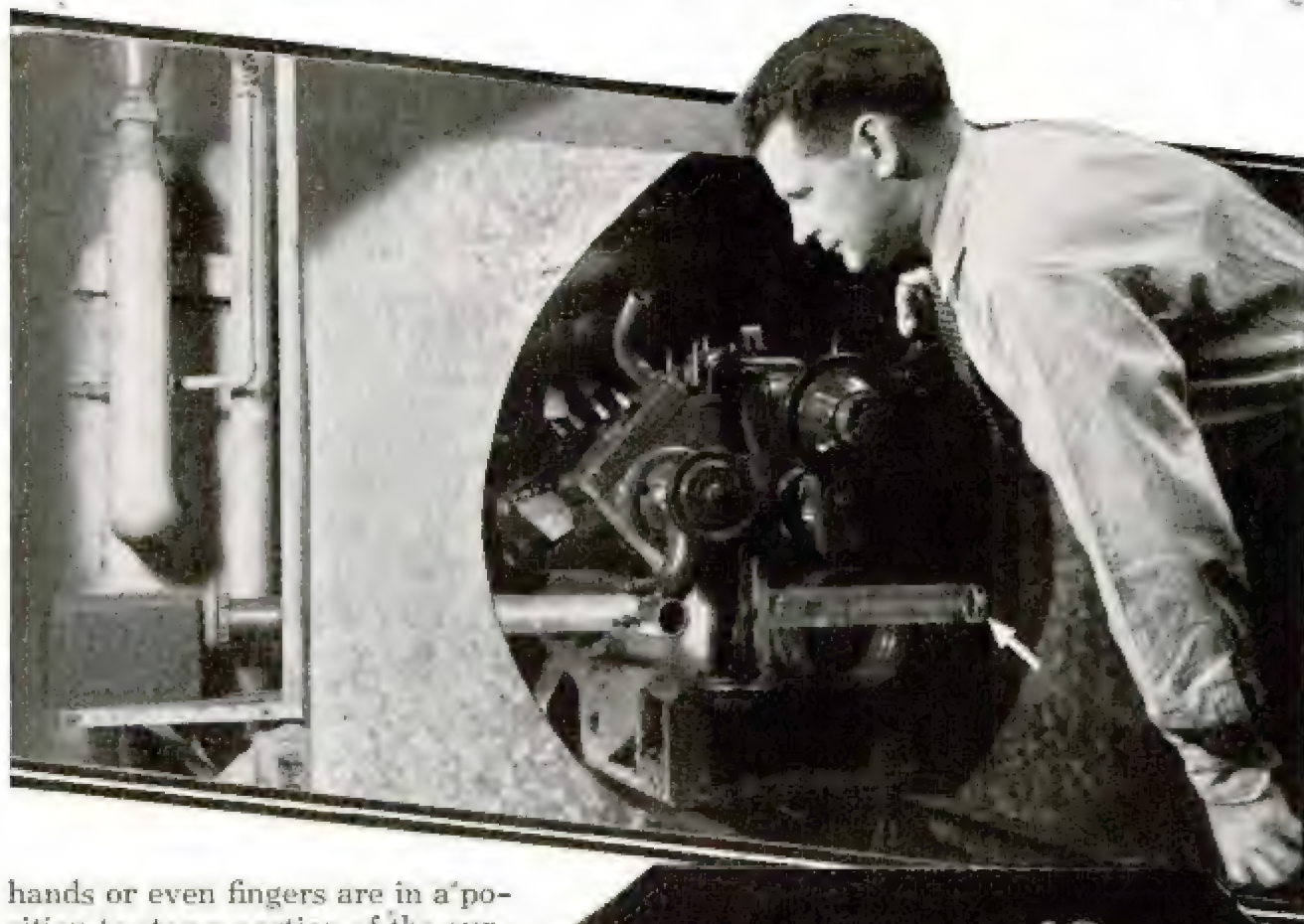
The automotive industry wanted a new way to heat rapidly the tips of valve stems for hardening and the central portion of front axle kingpins for annealing. The section to be heated actually became what might be termed the short circuit of the

heating transformer, a low voltage at high amperage. As soon as the primary of the heating transformer was turned on, the section to be treated would heat rapidly. An electric eye looking at this heated section turns off the primary of the transformer when the correct temperature is reached.

Owners of large punch presses used in forming sections of automobile bodies desired to offer their operators greater safety. If the operator happened to have a portion of his body in the way of the closing dies of these presses, it was almost certain to result in a serious, perhaps fatal accident. Now a light source, projecting a curtain of light two inches thick and thirteen to thirty inches high, is directed across the opening area of the press. This curtain of light is picked up on the other side of the press by a series of electric eyes, which, with their optical system, make every section or portion of the ribbon of light sensitive to interception. The result is a wall of light around the dangerous area. As soon as an operator's arms,



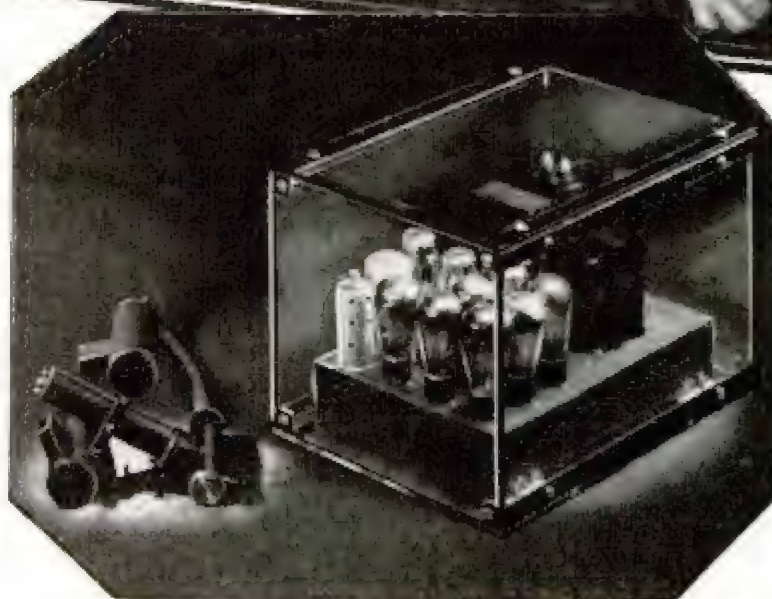
Photocell housing receives curtain of light from source at right. The amplifier, with relays for press operator safety, is shown at center



hands or even fingers are in a position to stop a portion of the curtain of light from reaching the photoelectric cells, the press stops and remains stopped until the obstruction is removed. So rapid is the operation of the electric eye and its vacuum-tube amplifiers that some large embossing presses will stop within three-eighths inch if a portion of the light curtain is obstructed by an article no larger than a lead pencil.

Electric eyes perform countless tasks for the average citizen. They inspect the razor blade with which he shaves, to insure its sharpness, and they are responsible for the grading of the grapefruit he eats at breakfast. When he drives into a filling station, an electric eye summons the attendant. Another checks the condition of the oil in the car's crankcase and a third determines whether headlamps require adjustment. On suburban streets traffic signals change as automobiles interrupt the light source of hidden electric eyes. The fast driver is trapped by two electric eyes which reveal his speed to police officers.

Heavy doors of office buildings and railway stations swing open mysteriously un-



Top, source projecting light beam through spray paint booth to photoelectric cell at right (designated by arrow). The motor has just intercepted the beam, actuating the counting mechanism installed in the production supervisor's office. Thus are motors counted. Bottom, amplifier with self-contained voltage regulator is housed in glass case to eliminate possibility of corrosion

der the influence of the electric eye when anyone approaches close enough to cross the light beam. In the elevator the protecting "eye" helps to prevent the door from slamming on hand or foot and stops the car at the exact floor level so passengers won't stumble when they alight. Even the drinking fountain in the corridor responds

(Continued to page 154A)

Pilot's Special Suit Helps Set Record for High Flying



Pilot in decompression chamber. Note the special flying suit which helped him reach record altitude

Clad in a special rubber suit and oxygen helmet, Lieut. M. J. Adam of the British Royal Air Force recently piloted his plane to a record altitude of 53,937 feet. Before the flight, the suit and helmet were tested in a decompression chamber in which were duplicated the atmospheric conditions of the upper air. The flight was preceded by a careful campaign of preparation which resulted in efficient functioning of the plane and of the pilot's protective clothing and helmet. Air of the proper consistency for the flier was supplied by the oxygen headgear. At the height attained by Lieut. Adam the air is much too thin for man to breathe.

Speed-Up of Telegraph Service Is Triumph of Metallurgist

Automobiles have increased their speed from twenty and thirty miles an hour to eighty and 100, streamline trains average a mile a minute across the continent, and airplanes have stepped up their flying speed from sixty to 200 and 300 miles an hour. But the telegraph has not been left behind. Metallurgists have helped increase the speed and capacity of telegraph and cable lines from thirty or forty words a

minute to as high as 2,800 letters a minute, a record made over a Western Union cable. Western Union scientists are constantly exploring metal under microscopes and in photographs magnified 2,500 times to develop superior steels and coppers and alloys that will resist wear, vibration, and the strain of increasing speed. Typical of the metallurgists' problems was the failure of a small escapement pin in a telegraphic stock ticker. Complicated alloy steels were tried without success, then the experts found that ordinary soft iron wire would give excellent service after a special treatment. Highly magnified photographs of a small steel part in a telegraph printer helped develop a metal strong enough to stand strain but soft enough to endure constant pounding.

Extension Handle on Mower Aids in Cutting Terrace

Grass can be cut easily on terraces by attaching an extension handle to the lawn mower. The handle is fastened at the base of the original handle so it is free to move up or down, according to the steepness of



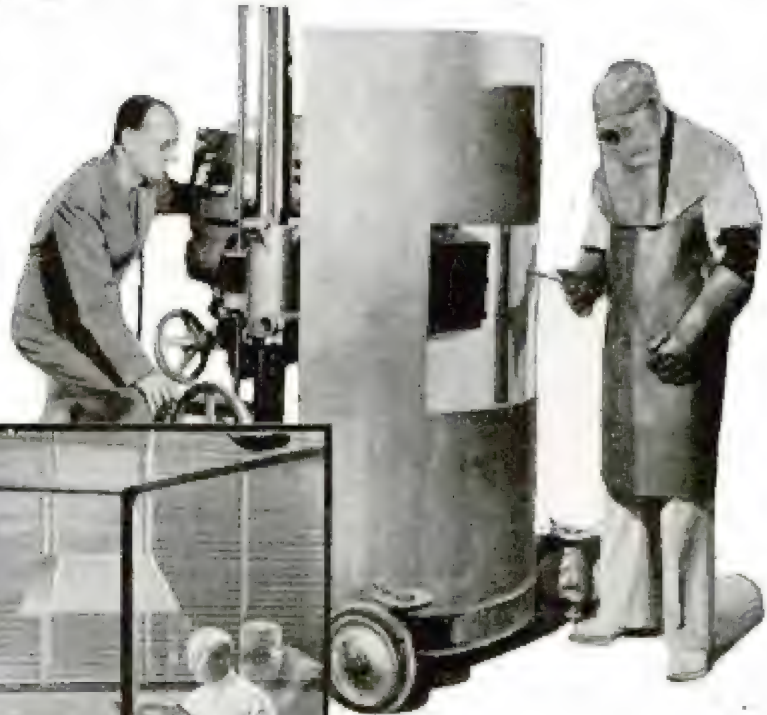
This extension handle on lawn mower makes it easy to cut grass on slopes

the bank. A rope attached between the two handles prevents the mower from dropping so far forward that it will not cut the grass properly.

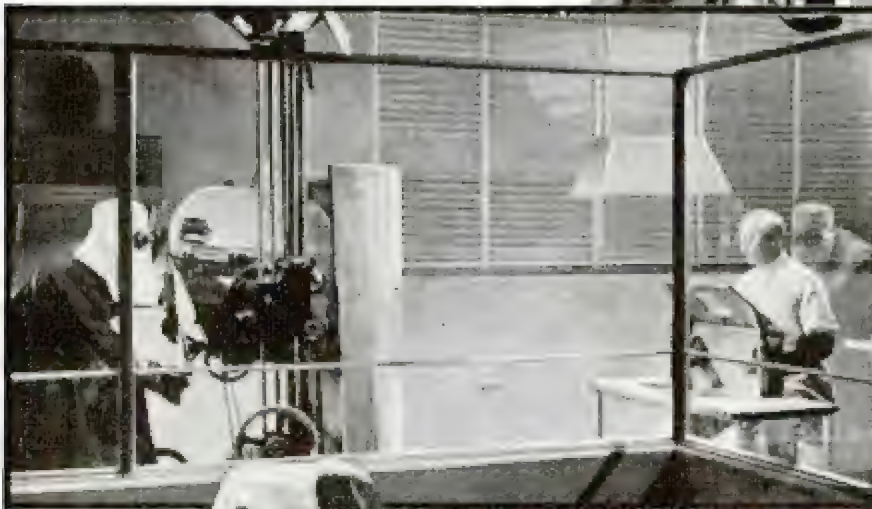
Wm. Paul McCre,
2228 Taylor St. N.E.

Shields Protect Movie Workers from Radium

When a motion picture dealing with radium was being made recently, all workers and even the camera were protected against the deadly rays of the element by shields made of lead. Handling of the radium was done by a scientist clothed in lead armor. At the same time the cameraman, also clad in lead armor, trained his camera on the \$25,000 capsule of radium.



Several views of precautions taken in making movie of radium. Note the shields used to protect men and cameras from the powerful rays



Million-Year History of Ice Age Told in Ten Feet of Sea Bed

In ten feet of sand and mud on the Atlantic ocean bottom scientists can read a million years of history of the Ice Age. Samplings have been taken from the sea bed across the north Atlantic with a cannon-like tube that is shot by gunpowder into the floor as it touches bottom. From these samplings the U. S. Geological Survey scientists have found evidence of advancing and retreating ice, of one-celled animals and of periods of volcanic activity, the latter indicated by layers of ash thrown off perhaps by eruptions in Iceland.

Skyscraper Building Is Silenced as Welding Replaces Noisy Riveting

Steel skeletons can at last rise silently in New York City, for the new building code sanctions welding in the construction of skyscrapers and the noisy rat-tat-tat of the pneumatic riveter is no longer necessary. Welding is a relatively new method of joining steel and it has made the old building codes out of date. A joint prop-

erly welded is as strong as the members it joined, and this makes it possible to simplify building details and effect a saving of four to ten per cent in the amount of steel used. Several hundred large buildings have already been erected by the welding process where outmoded building codes do not prevent its use.

American Welding Society
33 W 39 St New York

Vast Earth Dam Spans San Gabriel Canyon



Terraced earth and granite dam is three-quarters of a mile wide at top, spanning San Gabriel canyon near Azusa, Calif. Its base is nearly 2,000 feet thick and there is room on top for a forty-foot road

Nearly 400 feet high and stretching three-quarters of a mile from one rock wall to the other is the new San Gabriel dam, largest earth-fill structure of its kind. The last truckload of granite was dumped into its terraced wall recently. At its base the dam is 1,950 feet thick, and broad enough at the top for a forty-foot highway.

Its reservoir has a capacity of 56,800 acre-feet of water, with a spillway large enough to handle 240,000 cubic feet of water per second if flood conditions require it. The fill called for approximately 10,600,000 cubic yards of earth and rock, quarried near the dam site. The dam was started eight years ago and cost \$16,000,000.

Twin-Motor Pusher Plane Has Guns Mounted in Nose



Going back to the "pusher" design of early aviation days, this twin-motored army plane has propellers at rear and guns in front

Departing from conventional military design, the latest army fighting plane reverts to the "pusher" type of pioneer aviation days. Twin motors drive the two propellers mounted behind the wings. This leaves clear vision and a free field of fire for the gun-

#1, Azusa, Calif.

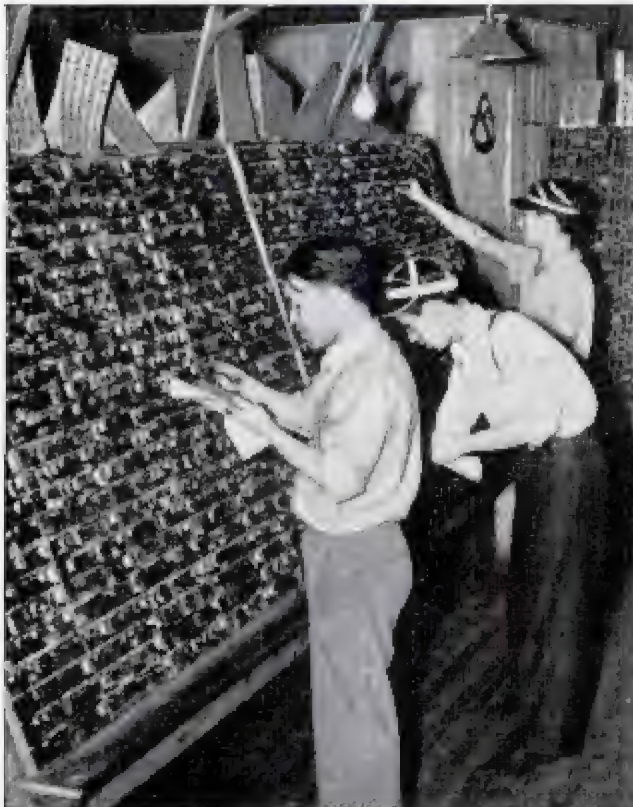
Bell Aircraft Corp. Buffalo, N.Y.

es 826

ners, pilot and observers in the three forward cabins. Designated as the "XFM-1" because it is an experimental multi-seat fighter, the first ship of the new type has been turned over to the army at Wright Field, Dayton, O., for test flights. It was developed for the purpose of giving battle to giant bombing planes of the "flying fortress" type being built for the world air armies. A crew of five mans the low-wing, all-metal monoplane and handles its six guns and light bombs.

Chinese News Set by Hand with Thousands of Letters

Setting type for the "war extras" printed in this country for Chinese readers is a laborious task. The type is set by hand, and it calls for skilled hands since the Chinese type case contains thousands of characters compared with the twenty-six-letter alphabet of the English language. Copy is posted at the top of the case and the Chinese typesetters watch it as they pick out the characters and arrange them in "galley."



Press time in a Chinese newspaper office in Chicago. The type cases contain thousands of characters

Bicycle Propels a Rowboat with Double Paddle Wheels



Here is a rowboat that is pedaled instead of rowed. A bicycle frame is mounted in it, and the pedals turn paddle wheels

Going to sea on a bicycle is not so ridiculous as it may sound. A bicyclist at West Bridgewater, Mass., has built a water bicycle for waterway touring. He installed a bicycle frame in an ordinary rowboat, and the pedals turn twin paddle wheels. The paddles have canvas guards to keep from splashing water into the boat.

Clamp Holds Paintbrush Suspended Inside Can

Instead of laying a wet paintbrush on a paper or rag where it will stick and pick up dust, you can snap it into a brush holder which suspends it inside the edge of the can. The spring-steel holder clamps on the can easily. It can be used as a handle for lifting a paint-smeared can.



Ⓢ Synthetic peppermint has been developed in Japan by a secret process employing the waste chlorine by-product of the soda industry.

Chicago San Min Chinese paper.

Industrial Research Institute, Tokyo

David-L. L. Corp
19 Paul Place
New York
compressed
air magazine
July 1939

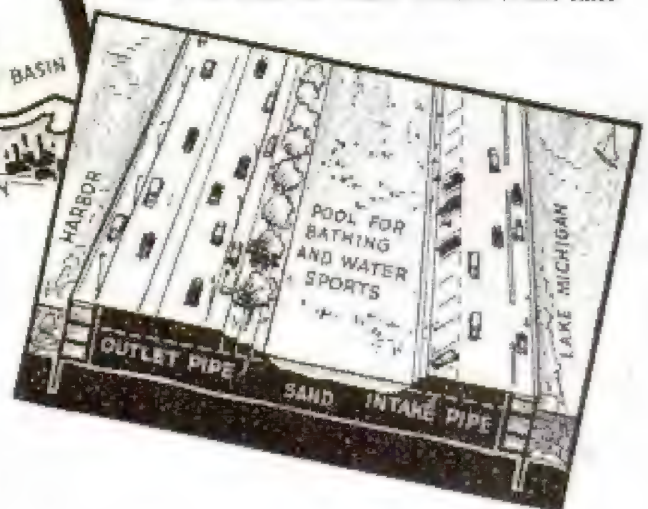
Chicago Dams River and Plans to Span Lake



Superhighways on dikes across corner of Lake Michigan, separated by bathing lagoon, are proposed in Chicago lake front improvement plan

Chicago is locking up forever the "river that runs uphill" and is talking of a gigantic dike along its lake shore that will provide a seventeen-mile swimming pool and an express highway giving motorists a short cut to the east. The \$3,000,000 dam at the mouth of the Chicago river is under construction and will be in operation by the end of 1938. Breakwaters will separate the lake from the river and inner harbor, and every ship and small boat entering the river must pass through a lock, whose in-

Photo courtesy United Air Lines
Ship lock under construction will prevent Chicago river from backing up into lake. Dotted lines show where sea walls will be built to shut off inner harbor from lake



ner dimensions are 600 by eighty feet. This lock will maintain a river level about two inches lower than that of Lake Michigan, its purpose being to prevent pollution of Chicago's water supply by any sudden outflow of river into lake, which occurs sometimes during heavy rains. Originally the river emptied into Lake Michigan, but

Chicago turned it backward to carry its sewage into the drainage canal. Late this year the new bridge spanning the river mouth will be completed, linking the shoreline drives north and south of the downtown section and relieving congestion on Michigan boulevard. Now engineers propose to span lower Lake Michigan with twin dikes leading from Chicago to the Indiana shore. Highways on the dikes would offer an easy entry into Chicago from the east. Sand would be pumped in to fill the 300 to 450-foot space between the dikes, and in the center would be a 100-foot bathing pool with intake pipes from the lake and outlet pipes leading to the protected inner harbor. Engineers estimate the cost of such a project at about \$82,000,000.

Marksman Takes Odd "Stance" in Target-Shooting Contest

Soldiers flop down on their stomachs to sight their rifles for quick firing in the field, but a woman entered in an English target contest reversed the practice. She took an unconventional supine position, one hand on the gun and the other supporting her head as she looked through the sights mounted above the butt. A tripod supported the weapon.



Woman sharpshooter at English meet lies on back to take aim at target

Eight Fighting Speedboats Undergo German Navy Test



This fast little fighting ship is one of a flotilla of eight built for the German navy. Here it is taking its trial run on the Rhine

Plenty of fight in small packages has been the aim of German naval designers for the last several years. Supporting its few "pocket battleships" are flotillas of small torpedo boats and light attacking boats, such as the powerful little speedboat pictured here. This was one of a group of eight given trial runs on the Rhine recently.

Breathing "De-Icer" for Plane Reinforced to Resist Tear

Those rubber "overshoes" worn on the wings and tail surfaces of aircraft to prevent ice formation have been improved this year to resist wear and tear. Fabric reinforcing strips have been added to the rubber covering, and any tear developing in the cover will stop at the rib, letting the rest of the de-icer continue to function normally. The overshoes are operated by compressed air, pulsations expanding and contracting the rubber so that the ice breaks as fast as it forms and is stripped away by the rush of air.

Dept of Commerce
Washington

Helen Rottenburgh

Miss Helen Rottenburgh
Bisby Indiana

HOW *to* CARE for



What it takes: nitro solvent, oil, grease, rods, cloth and brushes



To clean barrels of shotgun, run this brass wire brush through them



Small patch moistened with nitro solvent dissolves powder in barrel



Here is the correct method of cleaning a shotgun—from the breech

Top, right, guns being used in the field. Left, top to bottom, various steps in proper procedure for cleaning shotgun



22cp. By Bob Becker, Sport Chicago Tribune.
A WELL-CARED-FOR shotgun or rifle is almost a lifetime "hunting partner." Cleaned carefully, kept well oiled and given adequate care, a gun will shoot straight, have smooth working parts and last many, many shooting seasons.

Here are some practical tips on cleaning firearms and caring for other equipment usually found in the hunter's kit. The first thing on the list in cleaning is to handle guns so they pick up a minimum amount of outside dirt or sand which may work into the mechanism, and to handle them in the field, the car or around the hunting cabin so that they get a minimum amount of abuse. The wise gun owner never lays his gun on the ground, especially on loose sand or dirt. In the winter he never stands his rifle or shotgun against a tree so it can fall into snow. Rifle or shotgun should not be rested in any position where it may fall over and thus get a sight or other part damaged. The hunter should watch how the gun is placed in a car or boat so that the barrel won't have the finish rubbed off or the stock

YOUR FIREARMS



injured and he should never toss his shotgun on the bottom of a muddy, dirty boat, on the floor of a dirty wagon or other place where it can pick up dirt or grit.

Hundreds of thousands of shooters are using shotguns in trap shooting, crow hunting, game-bird hunting and for other purposes practically the year round, and the rifle has great popular appeal, so most gun owners have to keep at the cleaning job winter and summer. Here are the things that have to be watched in the care of guns: first, the question of rust after a gun has been exposed to rain or snow, or after it has been placed in a damp place for any length of time; second, there is the big battle against fouling and rust in the barrel or barrels, and third, the problem of getting a high-grade oil into the locks and inner mechanism of the gun so that it will work smoothly.

Never let a dirty gun stand very long around the house or the hunting lodge. This may sound fussy, but it is a mighty sound practice to clean your gun in the evening after you have fired a good many rounds in it during the day—especially if the gun



Don't do this! The shotgun barrel should not be cleaned from muzzle



To keep the gun in working condition, use light oil on inner parts



Before you put the gun away, be sure to give the stock a rubdown



Lastly, clean outside of gun with a cloth moistened in light oil

Top, left, more game for the morning's bag. Right, one wrong and three right things to do in caring for your shotgun

*Non-ferrous
Antoine
33 Stalash Chas*

quicker this deposit is removed the better for the guns.

Here are suggestions on equipment for cleaning shotguns: first, a jointed cleaning rod with a slotted end. You have several sizes to fit different guns. You may use both a wooden, jointed cleaning rod and a metal one. A rod made of wood costs forty or forty-five cents and lasts a lifetime. The metal cleaning rod, even more durable than that made of wood, costs about one dollar. It has a threaded knob on the third joint so that you can put on any standard make of cleaner, such as a wool swab or a wire cleaning brush. Either of these types, picked to fit the gauge of your shotgun or shotguns, will do the job of cleaning. On long trips into the field when



has been in the rain or if you have been hunting on a snowy day.

Manufacturers have improved cartridges so that the primers do not induce rusting of the barrel as they did in the old days. But this should not make a shooter think that he can leave powder residue and effect of fouling on his gun barrels to be taken care of when he pleases. Another important fact is that the tighter the choke of your gun the more attention you must give to cleaning. In an ordinary twelve-gauge shell used for shooting clay pigeons more than one-third of the shot pellets come in contact with the barrel. If you shoot a full-choke twenty, sixteen, or twelve-gauge even more shot pellets contact the hot barrel as they pass out of the muzzle because of the constriction of the shot charge as it goes through the small opening. So all who use shotguns are up against the menace of metal fouling. The



Left, good shooting in the turkey country. Right, while on the way to and from the field, keep guns off wagon floor

there is a chance that you may misplace the jointed rod you may carry a field cleaner made of heavy cord. There is a weight at one end and bristle brush at the other. This is a mighty handy gadget. Besides the rods themselves you may want two or three brass wire or bristle brush cleaners on hand. You can get one for thirty-five cents which will last many seasons. These are to work on both metal fouling and powder residue just in case you develop a bad spot in the barrel from those causes.

Another important item in the outfit is

*Don Leugerske & Company
33 S Wabash Chicago*

the bottle of nitro solvent. This is a fluid that dissolves and removes powder residue. Today they are making the solvent as an oil so that the one fluid does two things—dissolves the residue and oils at the same time. Nitro solvent is a sort of short cut to clean gun barrels. It acts quickly and efficiently on the powder residue. If you do not have it in camp you may pour hot water through the barrels to dissolve the residue, but it is more work than if you use nitro solvent.

A small can of fine oil is excellent to have in the kit. You'll need it for oiling the inner parts of your guns. If you plan on putting your gun away for any length of time a heavy grease is a handy thing to use. This grease prevents rust. A tube which can be bought for as little as fifteen or



twenty cents lasts for a year or two. Some hunters like to insert anti-rust ropes in-gun barrels if the guns are to be laid aside for some time. They are wick ropes which should be saturated with grease or a good oil and then put into the barrels.

For rifles you may use the above oils and nitro solvent plus small metal cleaning rods to fit the calibers of the guns.

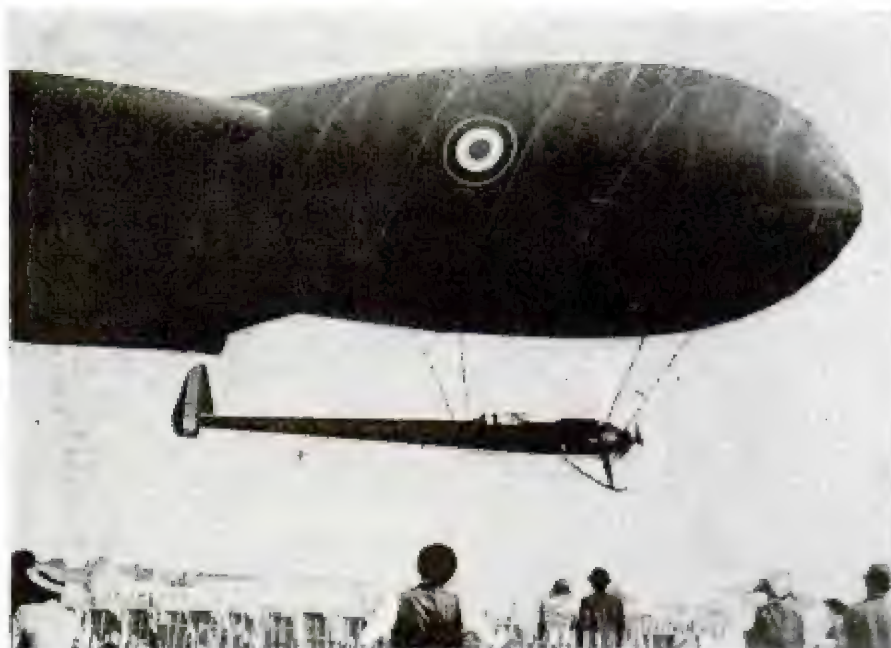
In starting to clean a shotgun, first take the gun apart. If you have been shooting in the rain, wipe off the outside very thoroughly. Then you are ready to clean the barrels. Have your brass brush and cleaning patches ready. If you have been doing a lot of shooting as, for example, at skeet or in the field after a day with the jacksnipe, pour a little nitro solvent in the barrels and then run the brass brush through them. Don't be afraid to run the brush back and forth vigorously. You are not going to hurt the steel of the barrels and this



Top, another hunting scene. Note gun propped against rear of truck. Center, wrong way to clean .22 caliber rifle. When possible, clean from the breech to avoid nicking muzzle with the cleaning rod. Bottom, after shooting in fog and rain, guns need cleaning and oil

(Continued to page 144A)

Fuselage Detaches from Blimp and Floats Down on Parachute



In case of trouble the fuselage may be detached from the balloon and floated to earth with the aid of a large parachute

One of the latest French aircraft is a dirigible, of the blimp type, which has a detachable fuselage that can float to the ground by parachute in the event of damage to the gas bag. The blimp, equipped with a power plant, is a motorized observation balloon.

Lower Mexico's Wilds Yield Strange Wood Specimens

Species of trees hitherto unknown to science are represented in the collection of wood specimens brought back from Lower Mexico recently by Llewelyn Williams, curator of economic botany at Field Museum of Natural History. Ten weeks were spent by the expedition, of which Mr. Williams was leader, in the timber camps of native Indians on the Coatzacoalcas river where the only food available was beans, tortillas, stewed armadillo, wild pheasant, iguana and the meat of javali, a wild pig. Most of the collecting was done on the Isthmus of Tehuantepec in the southern and eastern parts of the states of Veracruz and Oaxaca. The collection includes 2,000 specimens of herbs, shrubs and trees, more than 600 wood samples, and larger specimens of timbers and palms for use in museum exhibits. One tree found by the ex-

pedition was a wine-making palm. The natives cut it down, scoop a small trough in the trunk and cover it with leaves. After two days the trough is found filled with delicious red wine formed by fermentation of the sap. The traveler also may slake his thirst by sipping the water stored in the stem of the tecalate vine or in the fruit of the chichon palm, which must be broken open with the teeth. In the tropical Mexican forest was found the higua-amate tree, which grows only upon other trees, reaching a height of 100 feet itself and gradually killing the tree upon which it depends for support. Natives call it mata-palo, meaning tree-killer tree. The tallest trees reach a height of about 140 feet and some attain a size of six feet in diameter. Varieties range from the lightest woods like balsa to the hardest and heaviest like paki. One was a bamboo called jimba, dangerous because it bears pairs of long sharp spines which cause serious infection if they pierce the human skin. Another tree, much feared by the natives, exudes poisonous latex which causes blindness. It is the chechen.

Tester for Electrical Appliances Shows Up Bad Cord or Bulb

Requiring no batteries, and consuming no current when idle, a small testing board for electrical appliances infallibly shows up the faulty light bulb, fuse or cord. It will test any bulb from 5,000 watts to a one-volt flashlight bulb. If the appliance is in good order, an indicator light on the board flashes when contact is made with the test plates.



*Universal Sales,
1893 Clark Chicago*



Television RECEIVER for Experimenters

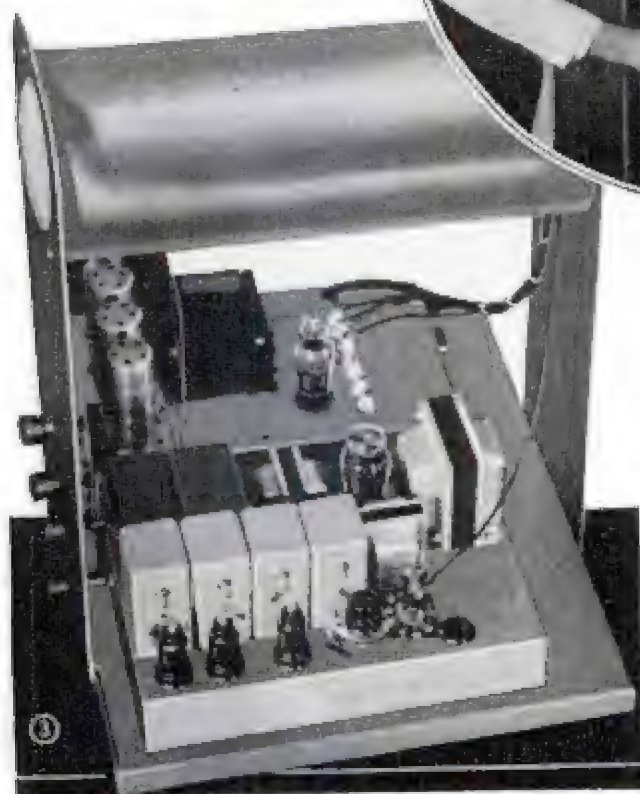
COMBINED sight and sound television programs are now available to west coast experimenters in and near Los Angeles from the Don Lee television transmitter W6XAO, which operates on 6 $\frac{3}{4}$ meters daily except Sundays and holidays. Reports on reception results are requested



from local experimenters, who are supplied gratis with complete construction details for building an experimental cathode-ray television receiver especially designed to receive images broadcast from W6XAO.

When transmitting film subjects, the sound track is broadcast from station KHJ on 900 kilocycles and synchronized with sight

from W6XAO; the image consists of 300 lines with a frame frequency of 24 per second. This received screen image, Fig. 1, is 6 $\frac{1}{2}$ in. high and 7 $\frac{1}{4}$ in. wide. All transmissions are made under the direction of Harry R. Lubcke, who is shown at the controls of the sight and sound receiver installed in his home which is located about 3 $\frac{1}{2}$ miles from both transmitters. Very satisfactory results have been obtained with the experimental receiver which appears in photo Fig. 3. A successful demonstration of the television receiving system was recently made at the California Institute of Technology, a distance of slightly more than 10 miles.



"KNOCKABOUT"

*has good tone
and volume*



SPEAKER NO. 2

SPEAKER NO. 1



HEAR VIEW

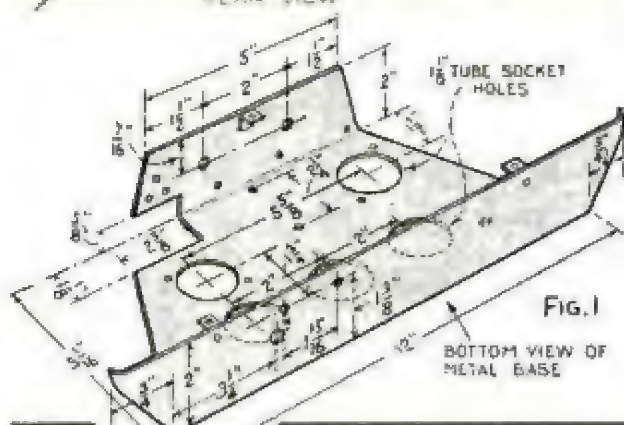


FIG. 1

BOTTOM VIEW OF
METAL BASE

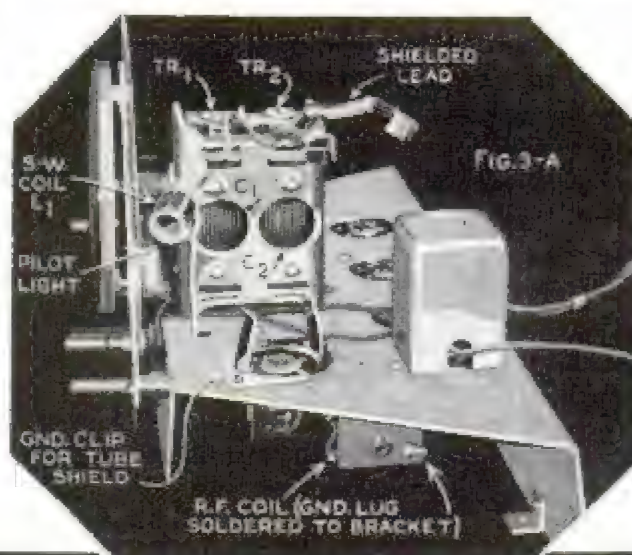


FIG. 3-A

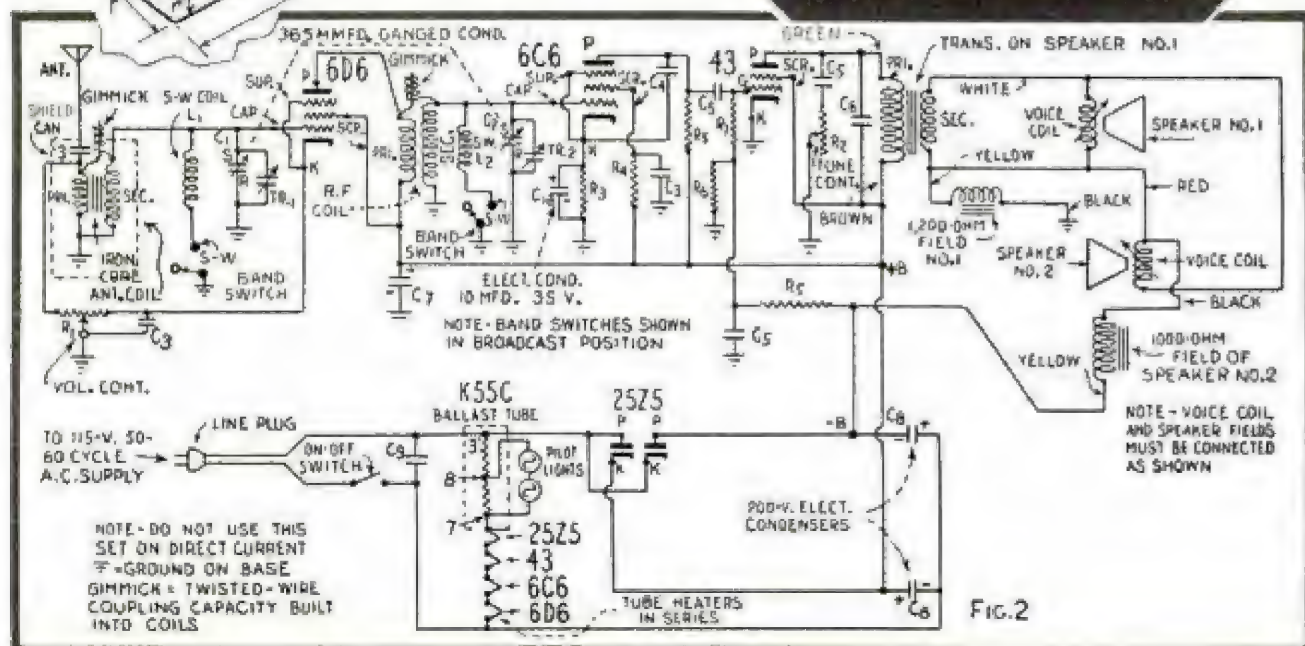


FIG. 2

Every step in the construction of the set is shown clearly in the various diagrams and photos. All parts are standard and inexpensive; complete base details are given in Fig. 1, the schematic circuit

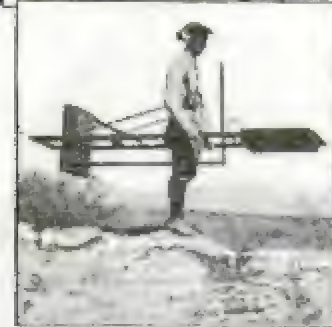
FIG. 9-8

— PEACH, FIELD



How to Build an Eight-Tube Radio Balance

By HARRY A. FORE
PART II



Above, D. G. Chilson operating his early model near Tucson, Ariz.



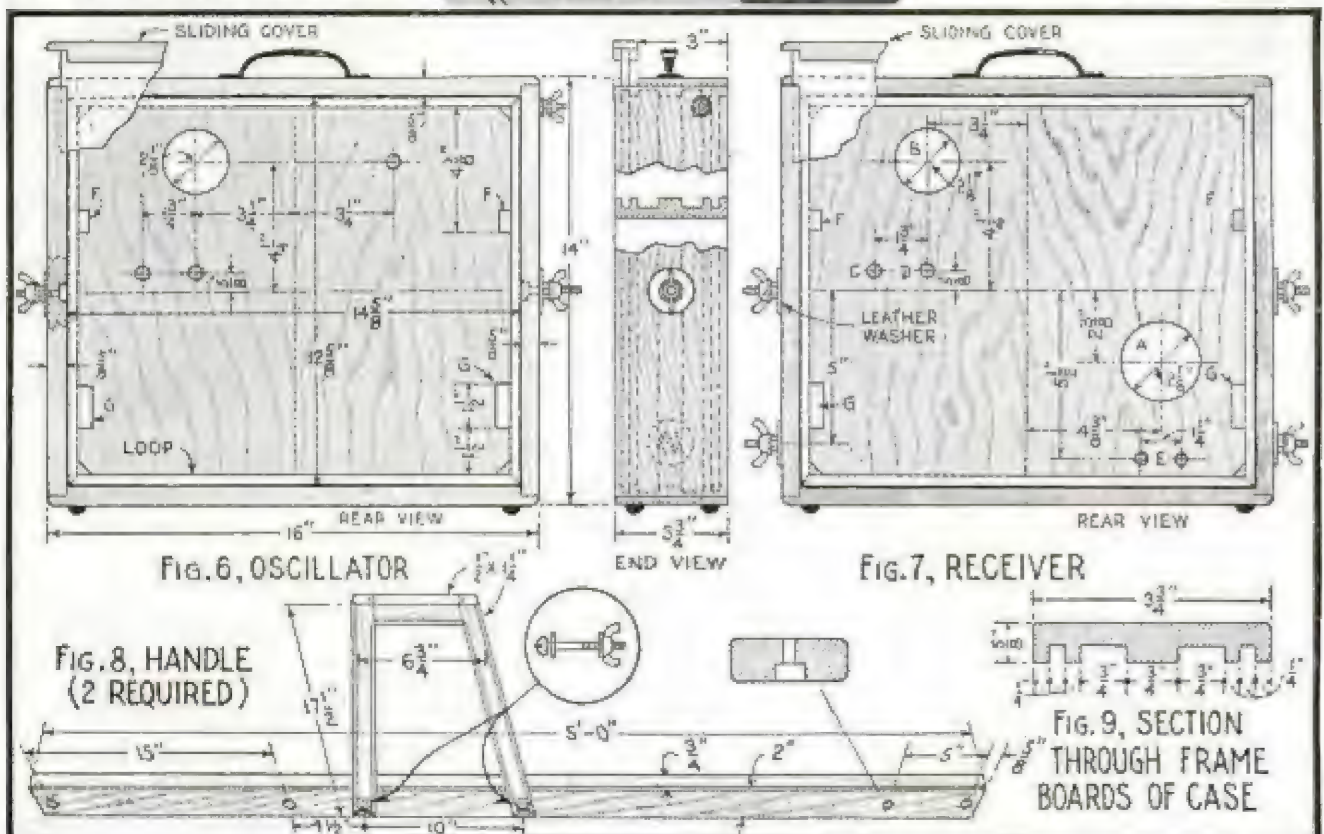
FIG. 7-B

AFTER completing the tube strips and loops for the metal-locating device, as detailed in Part I which appeared in the October issue, we are now ready to assemble the instrument cases that house the oscillator and receiver together with their respective batteries, meters and controls.

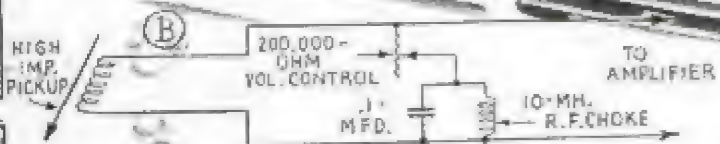
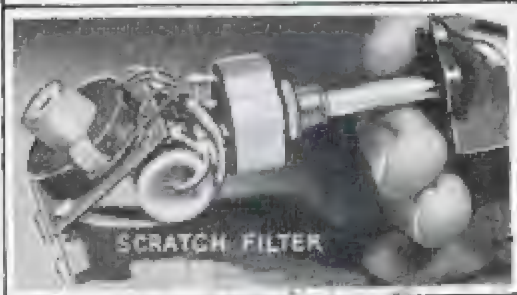
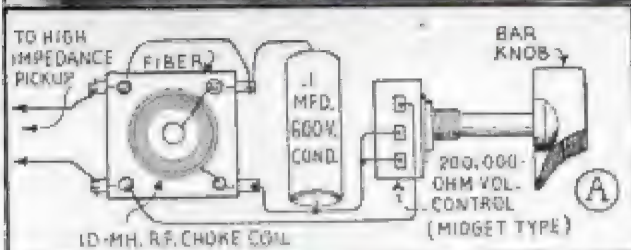
The side frames of the cases, Fig. 6 and Fig. 7, should be of good quality well-seasoned wood such as white pine or gum; the front and back panels are of 1/4-in. plywood. Both front panels, Figs. 6-A and 7-A,

may be screwed flush with the frames or they can be fitted into grooves as detailed in Fig. 9. It is desirable, however, that the rear covers slide in and out so that the batteries and tubes may be easily accessible for checking and re-

(Continued to page 150A)



Practical RADIO SUGGESTIONS



Scratch filter and volume control for use with any high-impedance radio-phonograph pick-up, eliminates scratch noises usually present at approximately 5,000 cycles. Simplified diagram A, and schematic B, show filter for about this frequency

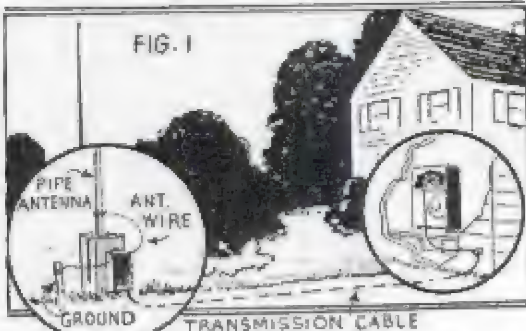


Fig. 1, noise-reducing antenna system employs RCA submarine cable as underground transmission line from receiver to vertical collector which consists of several lengths of ordinary iron pipe with reducing couplings, mounted in wood post at a convenient point some distance from the building

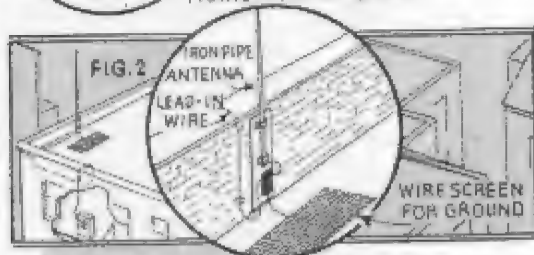
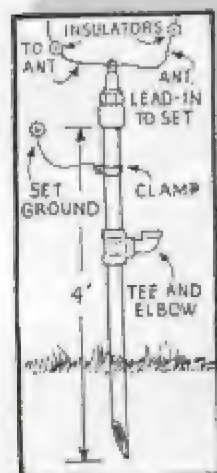
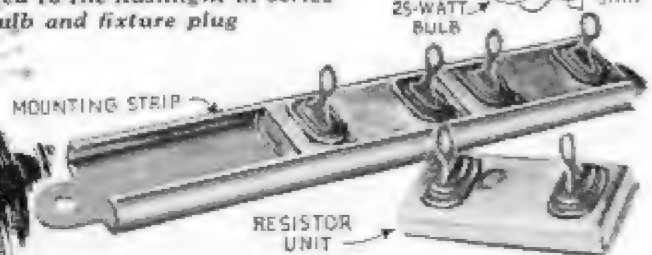


Fig. 2 shows a similar vertical antenna installed on an apartment building—screen wire is placed on the roof as a ground for the antenna-coupling transformer. These systems are neat in appearance, highly efficient and easily installed



Right, trouble light made from a pen-type flashlight is operated from 110-volt outlet instead of batteries. Flexible leads are connected to the flashlight in series with a 25-watt bulb and fixture plug



Left, spark plug and iron pipe make good lightning arrester and ground for set. Above, handy sectional resistor units for assembling your own voltage divider

Clarostat Mfg Co 741

285 N. 6th St. N.Y.

RCA Mfg Co. Camden, N.J.

Hand-Width Radio Set for Cars

the desired volume level when connected to a receiver loudspeaker of any impedance value.



This tiny auto receiver has recently been placed on the market by a British manufacturer. Mounted by means of a single bolt, it is provided with a remote control which is fastened on the steering column of the car. The set has an illuminated dial for a double-wave band. This band switch is operated by pushing either of the small knobs located on the lower edge of the dial.

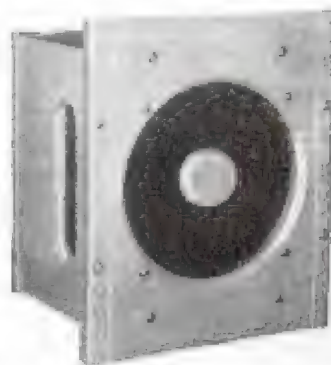
Extension Speaker Is Portable

Radio servicemen will find this portable extension speaker useful in demonstrating the convenience of having extra speakers in the game room, den, porch or garden. A 6-in. permanent-magnet speaker is housed in the attractive cabinet and the unit handles a 5-watt output without distortion. A universal transformer provides



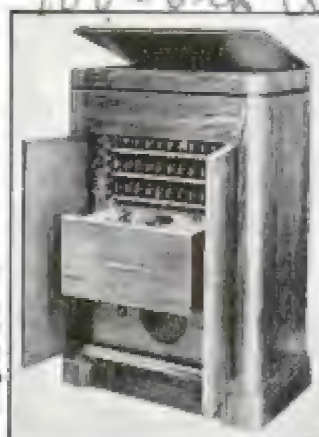
Complete Speaker in Kit Form

No baffle is required for this peri-dynamic reproducer which is available in a kit which consists of speaker, knock-down enclosure and all necessary screws, bolts and brackets. Two



models are available, one is recommended for general use, especially where high-quality music is desired, and the other where reproduction of speech is of greatest importance.

Address System for Schools



Under individual control of the central board, as many as 30 classrooms can be provided with two-way communication by means of this compact public-address unit. Available custom-assembled to meet special requirements, the speaker

switching controls may be added in blocks of 10. The system consists of radio tuner, phonograph, amplifier and controls.

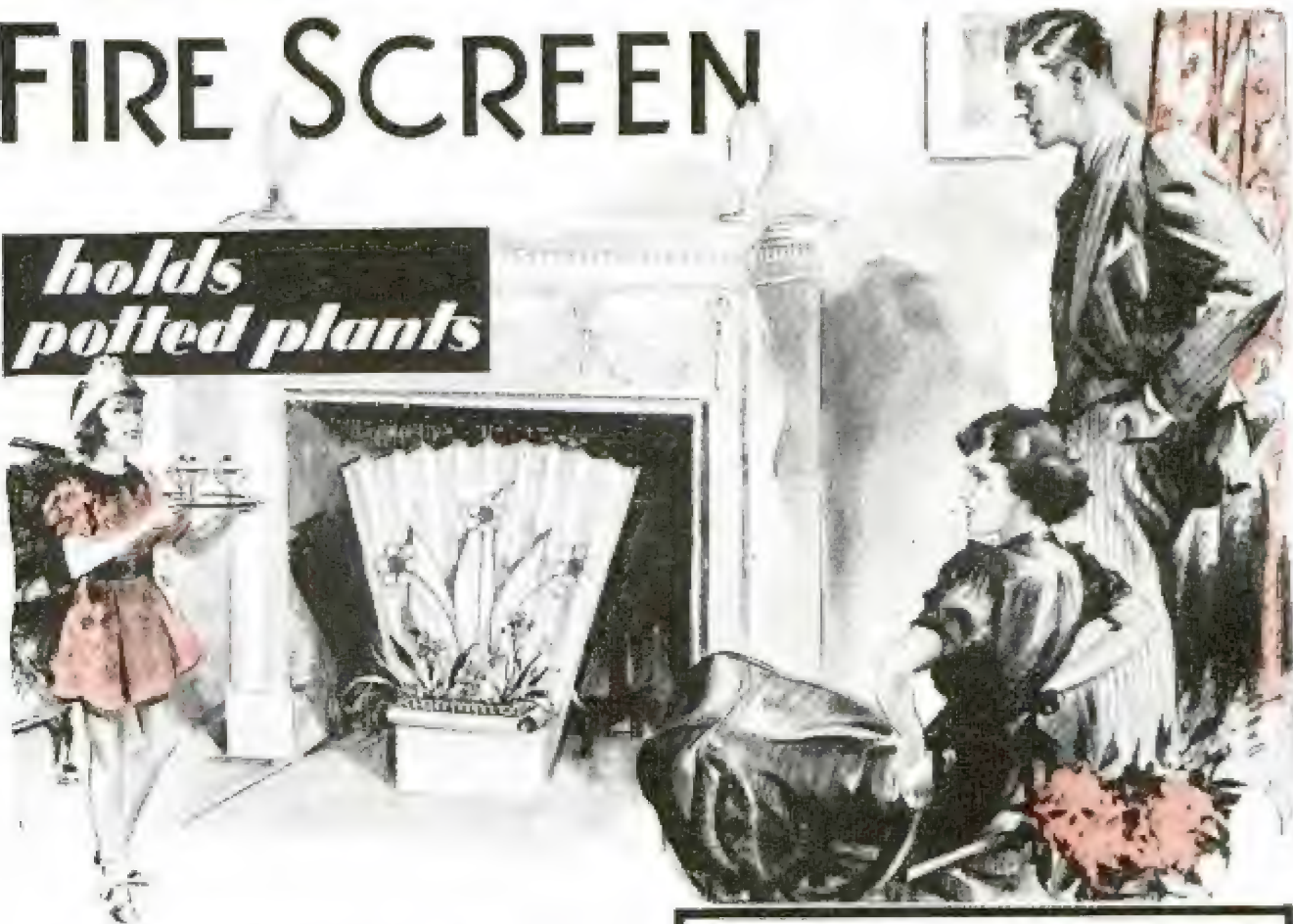
Blueprints covering radio construction articles in past issues are available for 25 cents each; original material lists and additional information can be obtained from our Radio Department without charge upon receipt of postage.

NEXT MONTH—How to Build a Two-Tube Portable Emergency Receiver. A simple, self-contained battery-operated broadcast set that you can take to ball games or install on your bicycle. Also, **How to Build a 13-Tube 7-Watt A.C.-D.C. Audio Amplifier Without Transformers or Chokes;** breadboard layout, easy to assemble.



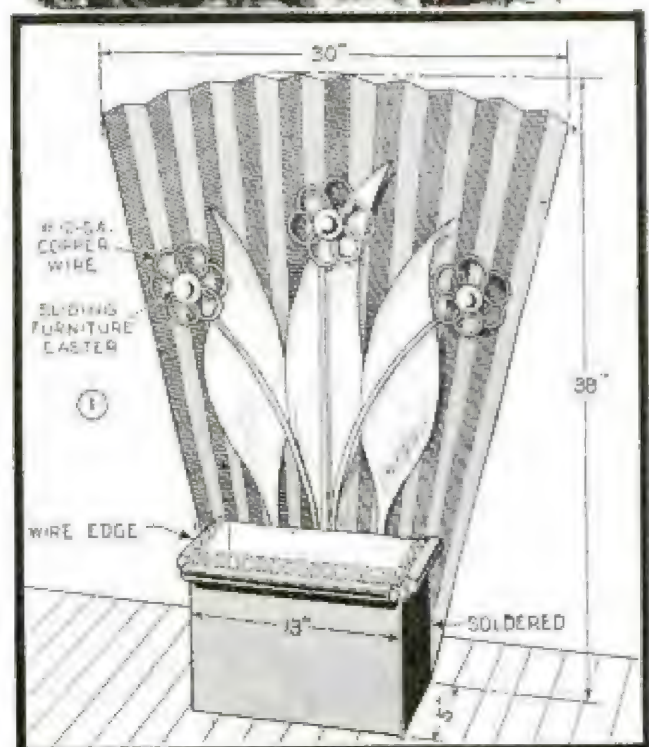
FIRE SCREEN

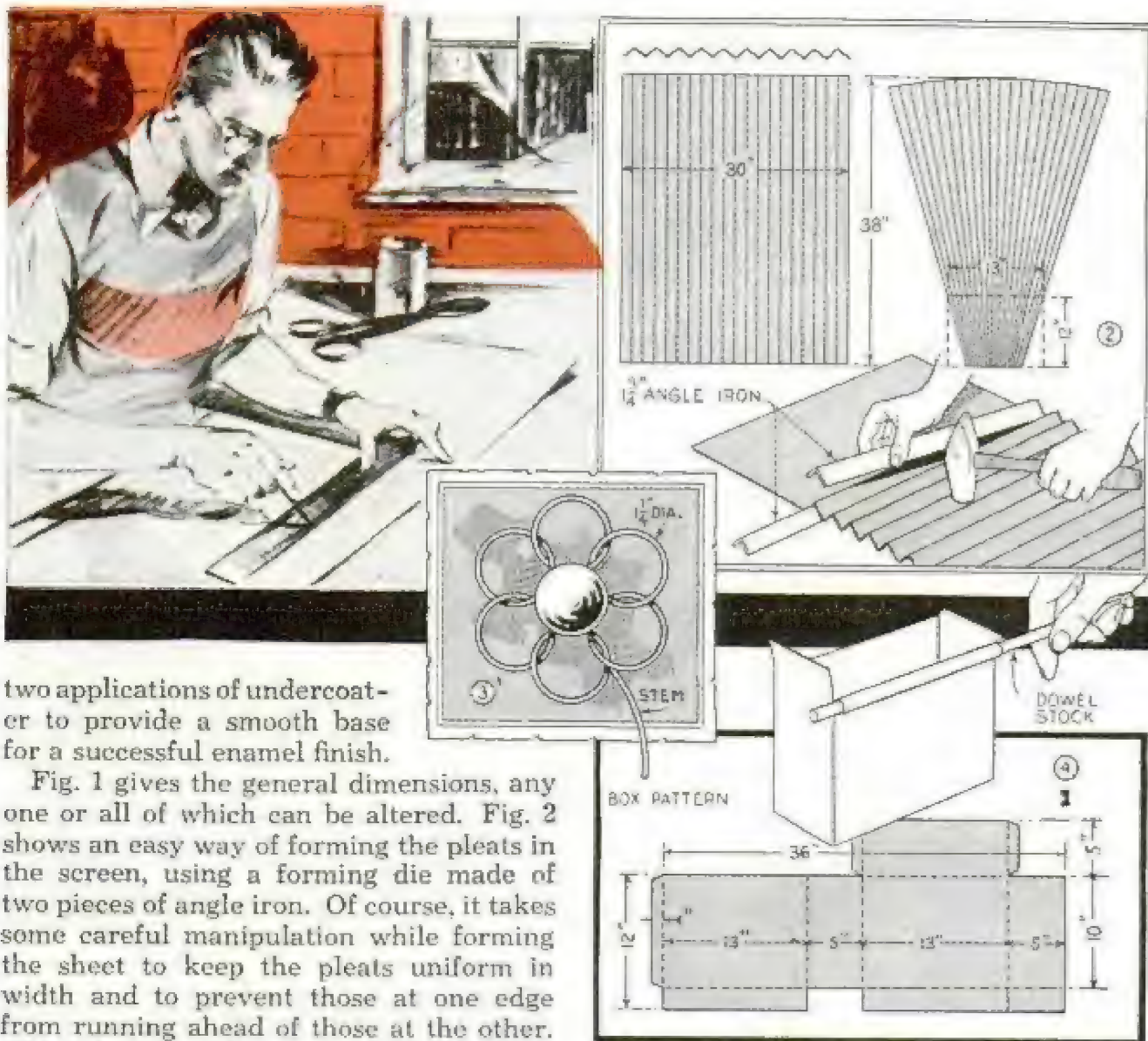
*holds
potted plants*



Wire flowers and metal leaves "grow" against a pleated metal background spread like a fan in front of the fireplace opening

IT'S especially effective in screening a false fireplace because the flower box, which serves as a base, is sufficiently large to hold several potted plants, the latter a pleasing complement to the artificial flower decoration. Soft sheet brass, about No. 26-ga. for the screen and No 18-ga. for the flower box, is the material that will work up best. If you wish to enamel the entire unit in bright colors, you can use light galvanized iron, of course. This material is somewhat more difficult to bend and shape and the surface will require at least





two applications of undercoater to provide a smooth base for a successful enamel finish.

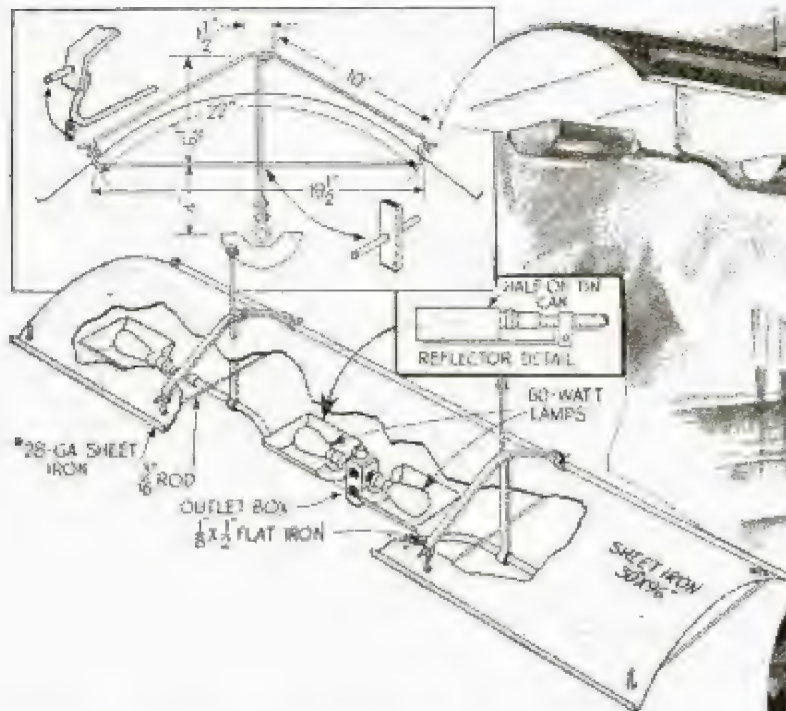
Fig. 1 gives the general dimensions, any one or all of which can be altered. Fig. 2 shows an easy way of forming the pleats in the screen, using a forming die made of two pieces of angle iron. Of course, it takes some careful manipulation while forming the sheet to keep the pleats uniform in width and to prevent those at one edge from running ahead of those at the other. When the pleats have been formed to the required width, you simply press them together at one edge to form the fan. This done, the construction goes on to the flower box, Fig. 4 showing how to cut the sheet from which to form it. After getting the sheet cut to the sizes indicated you bend on the dotted lines, hold the box together with wire and solder the joints. The projecting lips are then bent over a length of dowel to form the rolled edges as shown. A looped wire trimming, Fig. 1, finishes this job. Fig. 3 shows the "flowers," the petals made with interlaced loops of wire, the center being a sliding furniture caster and the stem a heavy wire. The three leaves, Fig. 1, are cut and shaped from light sheet stock. Now if you have made all parts of brass, buff and polish them, set up the assembly and solder it together, then apply a coat of clear metal lacquer to prevent tarnishing. On the other hand, if you use galvanized iron, smooth up the

soldered joints with a file and apply two coats of undercoater. Rub this lightly between coats with fine steel wool. Then apply one or two coats of quick-drying enamel and rub this down with steel wool to a smooth, satiny surface.

Cutting Speed of Pumice Checked by Soap Lubricant

To guard against excessive rubbing in smoothing down successive applications of varnish, one craftsman effectively checks the cutting of the pumice by rubbing his felt, water-saturated pad on a cake of soap. The soap lubricant slows up the cutting considerably, allowing plenty of time to carry on the operation without fear of rubbing through the finish. Aside from this advantage, the soap can be wiped easily from the surface, leaving no greasy deposits which often happens when oil is used.

Indirect Bench Lighting Reduces Eye Strain



This lamp will soon pay for the time and trouble to make it by flooding your workbench with soft, diffused light that is easy on the eyes

By having your workbench illuminated with this diffused, shadowless light, you will not only reduce eye strain, but will be able to do better work. The sheet-iron reflector has the side edges turned up and stiffened with flat irons, and is held to a curved shape by iron-rod braces. The reflector is supported by two hangers as shown in the upper detail, the lower ends of the hangers having eyes bent on them to hold the conduit. This is connected at the center to a 2 by 4-in. outlet box, sockets being fastened to each side of the box. Other sockets are fastened in a similar way to pipe caps on the outer ends of the conduit. An outlet can also be placed on the front of the box for attaching soldering irons, etc. Small shields are made by soldering halves of can covers to sheets of tin 7 in. square. These are fastened under the lights. To get a soft, evenly diffused light, the reflector and the shields should be given several coats of flat white paint, preferably tinted with a little blue.

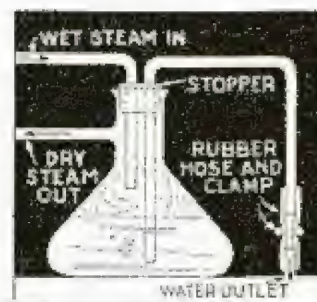
—Merle Terrill, Portland, Ore.

☛ If a muslin bag containing pine needles is laid on a warm stove or radiator, it will impart a pleasing aroma to the air and tend to remove mustiness from a room.



Chemist's Steam Separator Made from Flask

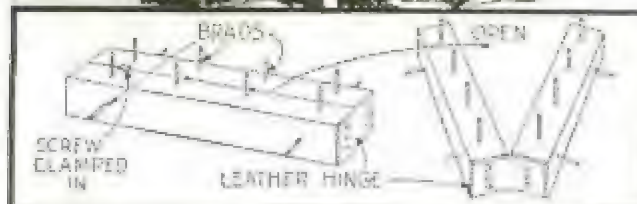
An ordinary distillation flask is easily converted into a laboratory steam separator. The trapped water can be siphoned away at a constant rate if the moisture



content of the wet steam is fairly uniform. As shown in the drawing, the device consists of a flask having a glass stem leading from one side of the neck and a rubber stopper through which two

glass tubes are inserted. One of the tubes is connected to the source of wet steam and the other one is connected to an outlet by means of a length of rubber tubing, the outlet being a sink or sewer. In use, the wet steam enters through the shorter of the two tubes from the stopper where it is robbed of its moisture inside the flask, and the dry steam passes out through the tube leading from the neck.

Jig Aids Modelmakers in Slotting Small Screws with Hack Saw



This jig holds small screws and has saw guides so that you can slot the heads accurately

Modelmakers who make their own small screws will find this jig just the thing for holding them to slot the heads. It is made from a couple pieces of wood, which are hinged together at one end with a strip of leather. In use, the jig is clamped in a bench vise with the screws to be slotted between the two pieces. Brads projecting from the top of the jig serve as saw guides, while those projecting from the sides keep the jig from slipping down in the vise.

—Chas. B. Kramer, Michigan City, Ind.

Cone Dodger to Enlarge Photos



Dodging of small areas of photo prints can be done with a paper cone which is placed over the end of the enlarger lens as shown. The cone must be made of fairly

heavy black paper. The size of the cone will depend on the type of enlarger used, and the size of opening in the small end

and the distance between the small end and the paper will determine the area exposed when dodging.

—Weldon H. Whisler, Davenport, Iowa.

Nursing Bottle Sterilized Quickly with Funnel in Hot Water

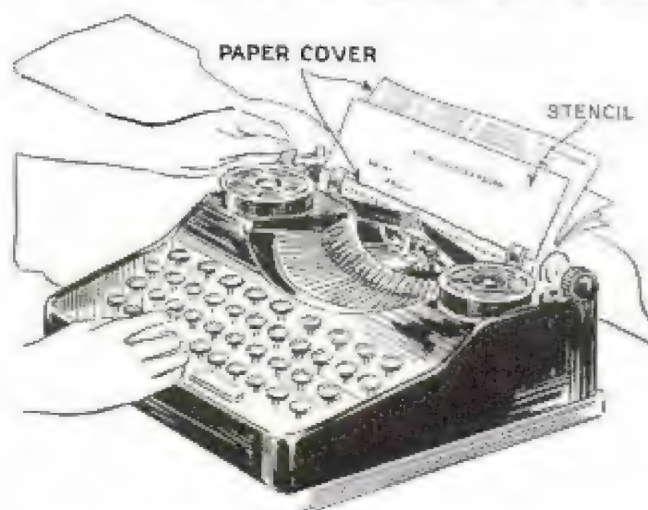
Nursing bottles are quickly sterilized by slipping them over the end of a funnel inverted into a pan of water boiling on the stove. With this arrangement, steam or hot vapors rising from the end of the funnel enter the bottle and completely sterilize it in a few moments.



Correcting an Inked Stencil

A mimeograph stencil that has been placed on the machine and become inked can be corrected in the typewriter easily. Blot off as much of the ink as possible from the stencil with newspapers. Next sandwich it between two pieces of the paper and place it in the typewriter. Then turn the platen and tear off the front paper so that you can reach the lettering to be changed with the stencil-correcting fluid. Remove the stencil from the mimeograph machine and the job is done.

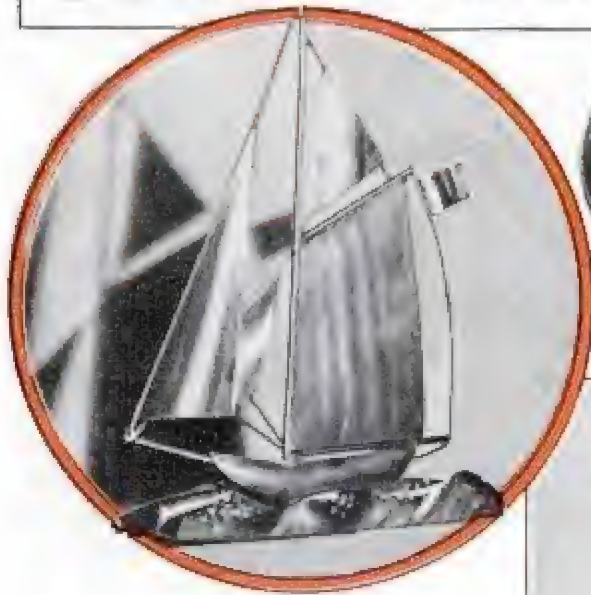
—Lawrence B. Johnson, Spokane, Wash.



Inked mimeograph stencil corrected in typewriter by placing it between two pieces of paper to remove ink

Art Work in

SHEET METAL



By AL BELANGER

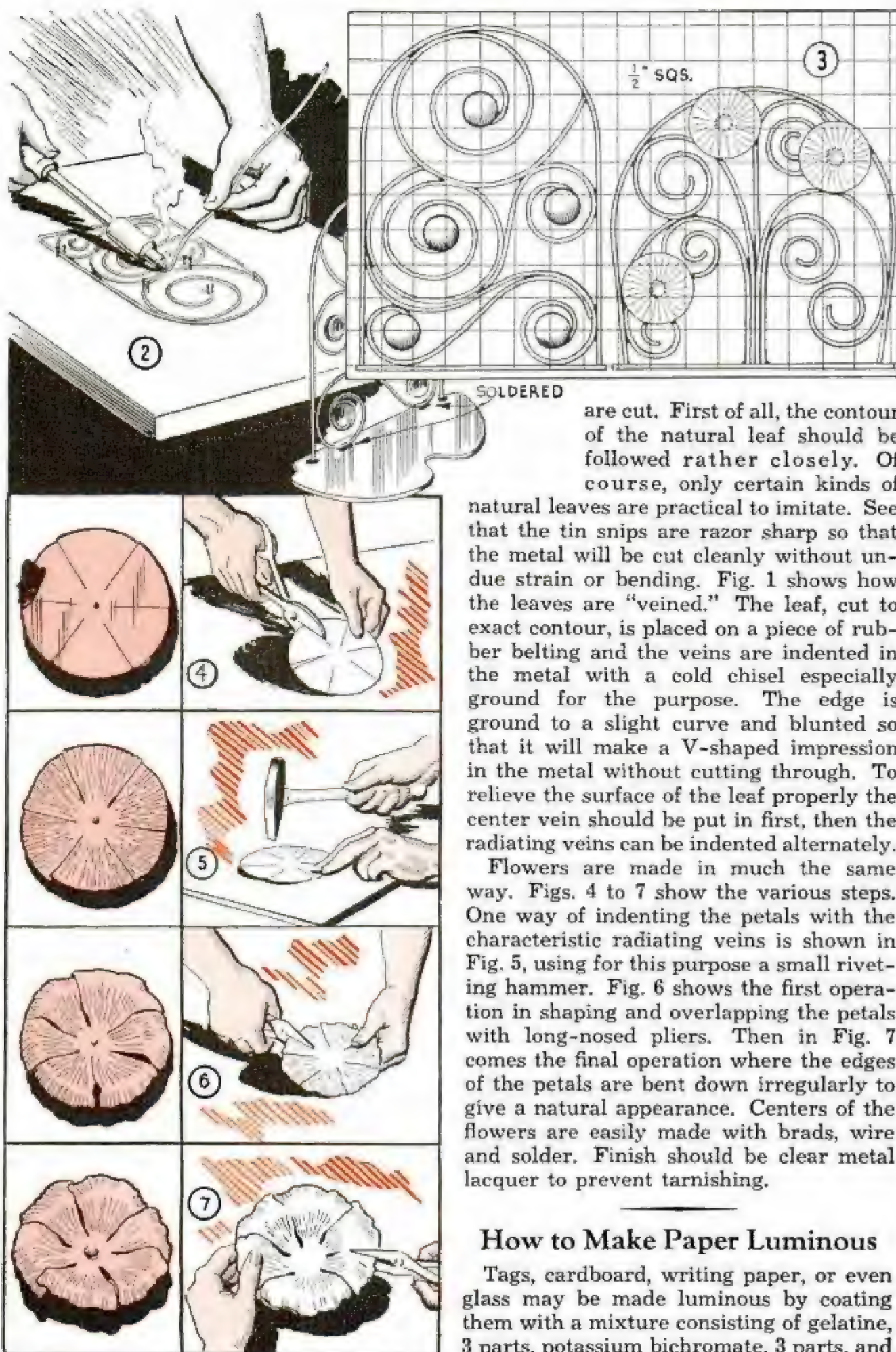
ONLY a few ordinary tools are needed for this interesting work. A moment's study of the examples pictured on this page will show what can be done. Most of the items are but combinations of metal leaves, petals, and wire work, with the single exception of the ship book ends, although parts of the latter are made with essentially the same technique.

Wire work is very easy. Take for example, the job shown in Figs. 2 and 3. To form scrolls such as those shown in Fig. 3 you grip one end of the wire with pliers and twist lightly, letting the wire pull through between the thumb and forefinger under some tension. Then a bit of bending here and there to straighten and even the curves, and you have it. To assemble any number of such scrolls, you first sketch a pattern of the design you want and transfer this to a



board. Then place the scrolls and border over the pattern and hold the parts in place with small brads while you solder the assembly together as in Fig. 2. For quick, clean work use a non-acid flux and a soldering iron a few degrees hotter than that normally used.

The trick in making realistic leaves of thin sheet metal is largely in the way they



are cut. First of all, the contour of the natural leaf should be followed rather closely. Of course, only certain kinds of natural leaves are practical to imitate. See that the tin snips are razor sharp so that the metal will be cut cleanly without undue strain or bending. Fig. 1 shows how the leaves are "veined." The leaf, cut to exact contour, is placed on a piece of rubber belting and the veins are indented in the metal with a cold chisel especially ground for the purpose. The edge is ground to a slight curve and blunted so that it will make a V-shaped impression in the metal without cutting through. To relieve the surface of the leaf properly the center vein should be put in first, then the radiating veins can be indented alternately.

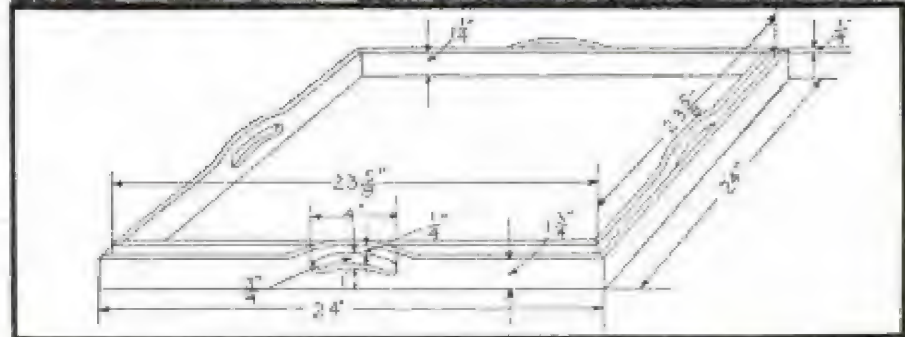
Flowers are made in much the same way. Figs. 4 to 7 show the various steps. One way of indenting the petals with the characteristic radiating veins is shown in Fig. 5, using for this purpose a small riveting hammer. Fig. 6 shows the first operation in shaping and overlapping the petals with long-nosed pliers. Then in Fig. 7 comes the final operation where the edges of the petals are bent down irregularly to give a natural appearance. Centers of the flowers are easily made with brads, wire and solder. Finish should be clear metal lacquer to prevent tarnishing.

How to Make Paper Luminous

Tags, cardboard, writing paper, or even glass may be made luminous by coating them with a mixture consisting of gelatine, 3 parts, potassium bichromate, 3 parts, and

luminous calcium sulphide, $37\frac{1}{2}$ parts, ground together to a fine powder in a mortar. To prepare the coating solution, dissolve 1 part of this mixed powder in $1\frac{1}{2}$ parts of boiling water and immediately flow the solution, or paint it, onto the surface to be made luminous in much the same way as you flow on varnish. Two or three coats may be required to give the best results. After exposure to the light for a short time the coating becomes insoluble, and paper thus treated may be used the same as any other paper. When the material is coated as described it remains luminous for some time after exposure to light. The mixed powder will keep indefinitely if kept dry in a tightly corked bottle.

Large Trays Contain Luncheon for Players at Each Bridge Table

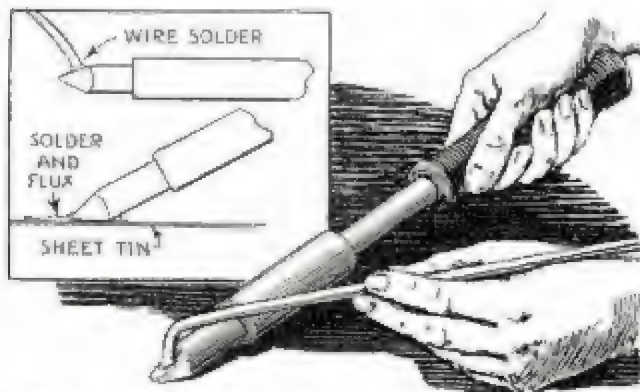


Serving light luncheons at bridge parties is simplified for the hostess by these trays, which contain luncheon for each card table

How to Tin Electric Soldering Iron to Avoid Discoloring Tip

Here is a quick, sure method of properly tinning a soldering iron. Heat it slightly until it will just melt the solder, rub the rosin-core solder over the tip quickly and then wipe it off immediately. At the same time, shut off the current. The trick is to remove the excess heat to avoid discoloring the tip by oxidation before the solder can be applied.

—L. H. Georger, Buffalo, N. Y.

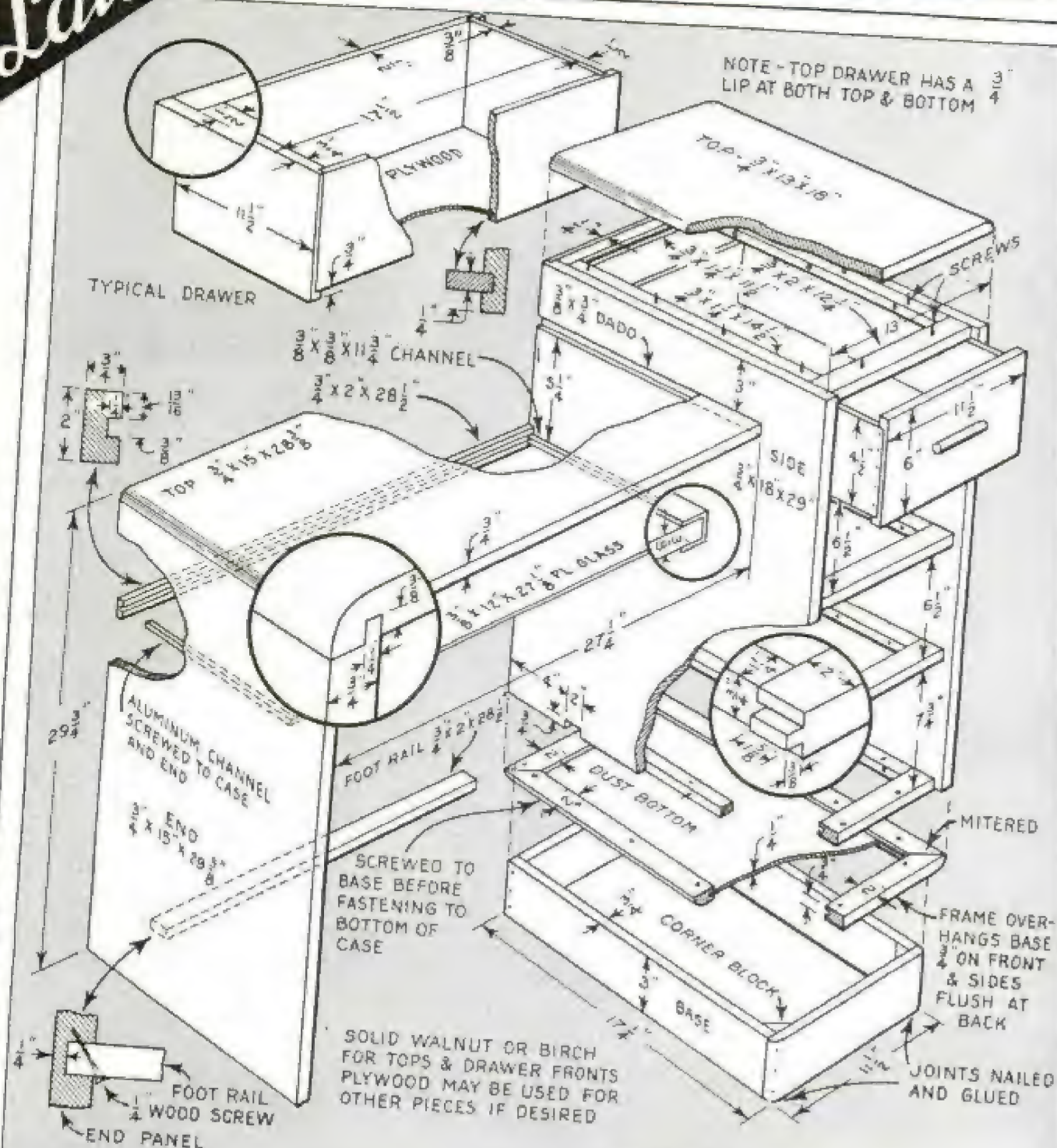


How to tin a soldering iron without permitting the copper tip to oxidize before applying the solder

Made in sets of two, three, or four these serving trays, which can be stacked one inside the other, simplify the problem of serving luncheons at bridge and club parties. With them, the hostess merely prepares a luncheon for each card table beforehand and sets them away until serving time when they are carried out and set on the card table in front of the guests. Clearing the table after the luncheon is over, is a simple matter as all you have to do is to pick up the trays and carry them out. The original set of trays were finished in ivory enamel with decalcomania transfers in flower designs in the corners and in the center. They also look nice when stained and varnished.—M. B. Birge, Hinsdale, Ill.

¶In doing delicate metal cutting with a scrollsaw the surface is sometimes scratched by the hold-down. To avoid this, cement a small, thick felt disk to the underside of the hold-down, to serve as a protecting pad. This kink is used by an engraver to avoid marring the polished surface of zinc plates.

The Latest DRESSING TABLE



NOTE - FIVE DRAWER FRAMES ARE IDENTICAL

MOD
SCALE OF
DESIGNED
DRAWN BY

Just the thing to complete the furnishing of a spare bedroom, this smart, modern table has a roomy glass shelf and four large drawers that can be partitioned as desired. The drawer-pedestal top is handy for a lamp to illuminate a wall mirror, and the bench, which matches the table, has a well to hold a cushion

POPULAR
MECHANICS
MAGAZINE

This Portable Sketching Board Has Knee Supports



Both your hands are free when you use this hinged support on your portable sketching board

Artists and others who often use a portable sketching board, which they rest on their knees, will find that this support enables them to keep the board at the correct angle without using the hands. A piece of 1-in. stock, notched to fit the knees, is hinged to the underside of the drawing board. Flat spring clips keep the support in position when in use.

Speed Wrench for Light Work from Ratchet Screw Driver



enough to slip into the screw-driver chuck, the lower end of the shank being provided

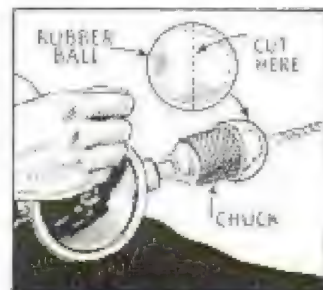
Tightening and loosening nuts on light repair work can be speeded up considerably by use of a wrench made from a spiral ratchet screw driver and a set of small snap-on sockets. The sockets are attached by making a short shank small

with a snap ball to hold the sockets in place. Such a wrench is also handy on heavier jobs where it is sometimes necessary to back off a nut that turns hard over a long run of threads, the nut first having been loosened.

—D. B. Harrington, Louisville, Ky.

Brace Chuck Protected by Shield When Drilling Plastered Walls

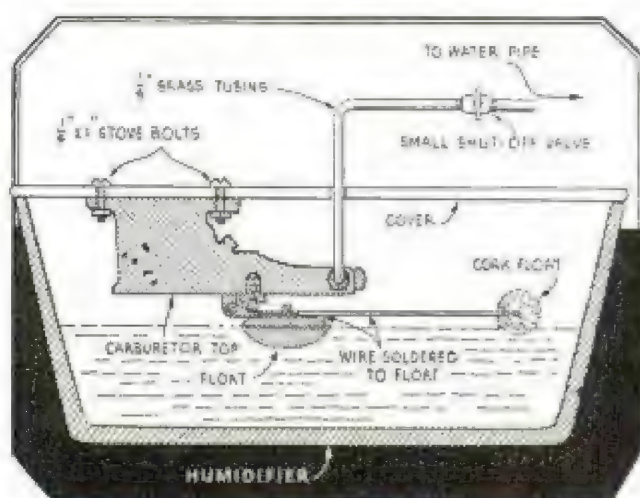
Unless some kind of a shield is slipped over a brace chuck, when drilling through plastered walls, the plaster is likely to work into the mechanism of the chuck and damage it. A shield for this purpose can be made in a jiffy by merely cutting an old hollow rubber ball in two and slipping one half of it over the chuck as indicated.



—E. T. Gunderson, Jr., Humboldt, Ia.

Humidifying Pan on Furnace Filled Automatically

Would you like to have an automatic arrangement to fill the humidifying pan on



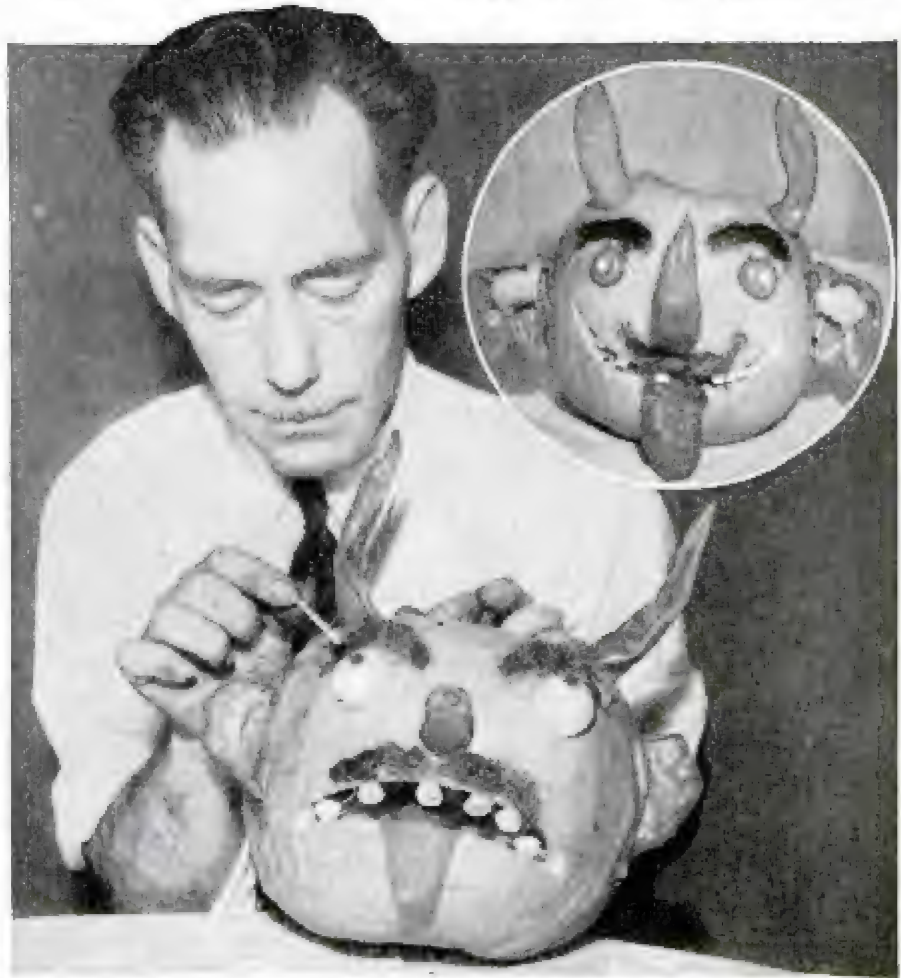
Old auto carburetor mounted in furnace humidifying pan automatically keeps it filled with water

your furnace? If so, one can be fixed up quite easily by using an old auto carburetor. The bowl is removed from the carburetor which is then turned upside down and bolted to the underside of the pan

cover as indicated, locating it so that the float of the carburetor extends well down into the pan. Then drill a small hole in a near-by water line, install a saddle valve, which you can obtain from any plumbing supply house, and connect the carburetor to the valve with a length of small copper tubing. It is a good idea to put in a small shut-off valve somewhere in the line so that you can shut off the water when it is not needed. If your water supply is under a fairly high pressure, it may be necessary to lengthen the float to increase the leverage by putting a large cork on a length of heavy wire, which is soldered to the regular float arm. The cork, of course, should be given several coats of shellac to keep it from becoming water-logged.

—William Riederich,
Flint, Mich.

Facial Features of Jack-o'-Lantern Are Made Amusing with Vegetables



You'll be surprised at the variety of facial expressions that you can put on a pumpkin jack-o'-lantern by using different kinds of vegetables

Containers for Small Amounts of Paint

Modelmakers and others who have small amounts of different colors of paint on hand will find that screw-top jars and bottles, such as those in which vaseline and cold creams come, make handy containers for the paints. Small metal-handled brushes from the dime store can be soldered to the jar tops with which to apply the paint.

This makes it unnecessary to clean the brushes every time they are used, as they are always immersed in the paint and will not dry out.

—John L. Story, Oklahoma City, Okla.



Amusing jack-o'-lanterns may be made with pumpkins and a few vegetables. For eyes, small white onions are used. Clip the roots off short and blacken those remaining with a burnt match to form the pupil. If desired, the stem ends of chili peppers may be used for eyes. The nose and horns are made with red chili peppers. White kernels of corn may be used for teeth, with yellow kernels for gold teeth. If the corn is soft, fasten the kernels to the pumpkin with small nails which will look like fillings. For eyebrows and mustache, use corn silks, attaching them with a good glue. The tongue is made from a red pepper.

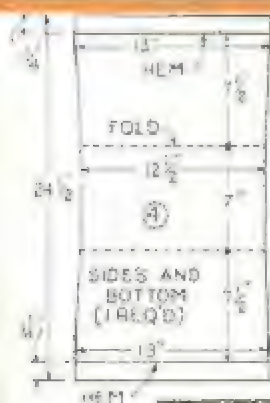
—N. H. Berlin, Rosemead, Calif.

☞ Before starting a meal, lay several thicknesses of newspaper in the sink, making a hole in them for the drain. Then put in all the black pots and pans to soak and the sink will not be coated with grease, which makes it difficult to clean.

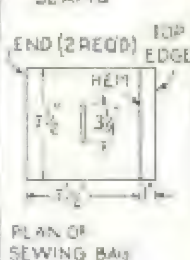
Craft with



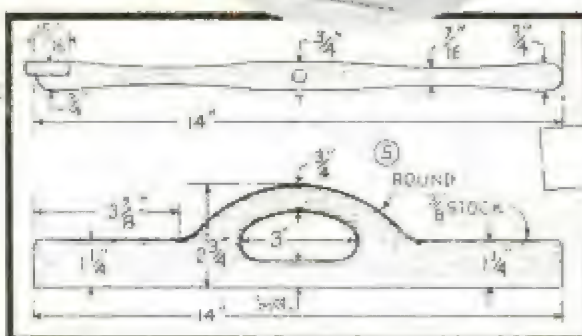
Sewing bag



DIMENSIONS
ALLOW 1/4" FOR
SEAMS



PLAN OF
SEWING BAG



Smart waste baskets

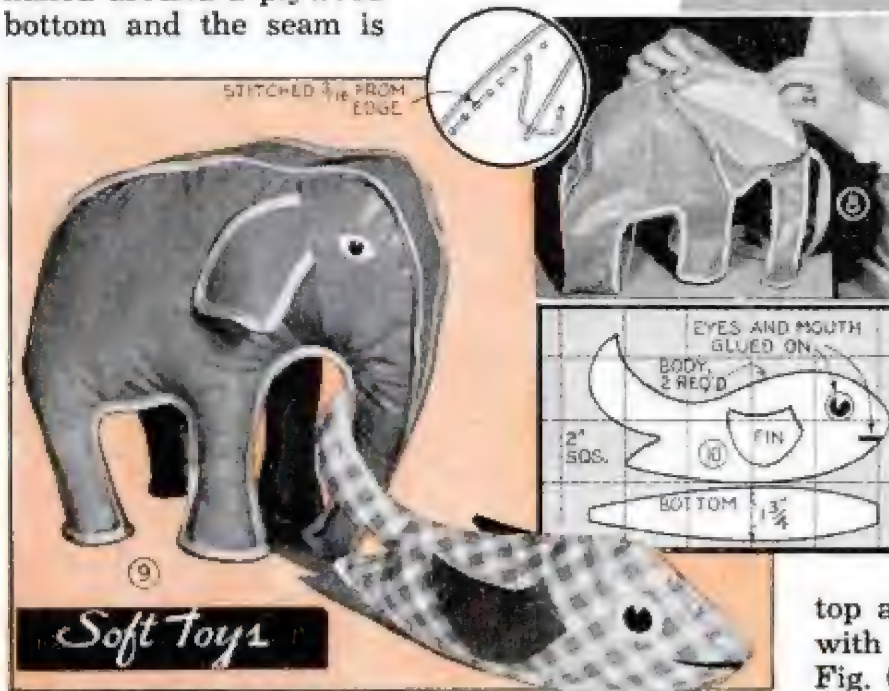
OILCLOTH is no longer the ugly duckling of the kitchen. Today, this new, soft-textured oil-color fabric is available in a rainbow of solid colors and patterns—a good material for a hundred-and-one practical projects. It is colored on the back as well as on the face side, making it ideal for such projects as the sewing bag detailed in Figs. 1 to 5. Fig. 4 shows how this bag is laid out on the back side of the oilcloth, ready for cutting. All edges are sewed together and then bound with bias tape in a contrasting color. Fig. 3 and

Fig. 5 give details of the wood framework over which the bag fits, while Fig. 2 shows how the bag is held in place with two 1/4-in. dowel rods.

One of the most attractive uses of oilcloth is in the making of col-

OILCLOTH

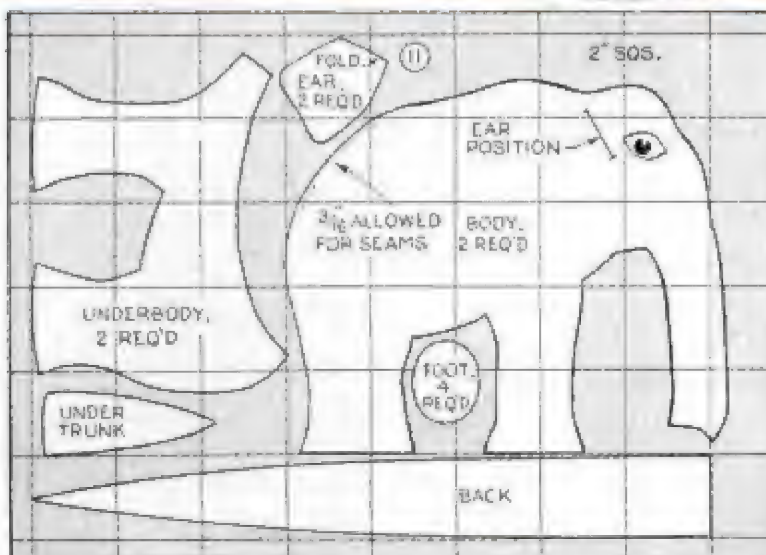
orful waste baskets. The fabric is easily pasted on any wood or cardboard box, using the same kind of paste used in hanging wallpaper. The photo below Fig. 6 shows three typical examples. The basket at the extreme left is a six-sided plywood box, each side measuring 6 in. wide by 11 in. high. It is covered with red oilcloth on the inside, and a pattern design on the outside. Oval baskets are made by commencing in the manner shown in Fig. 6 and carrying out the various steps shown, A, B, C and so on. A sheet of cardboard is nailed around a plywood bottom and the seam is



fastened with a strip of gummed paper tape. A second sheet of cardboard is then pasted over the first sheet, with the seam on the opposite side. Next, comes the application of the oilcloth, after which a strip of heavier cardboard can be pasted on at the rim to add stiffness. The baskets can be ornamented with contrasting bands of oilcloth at the

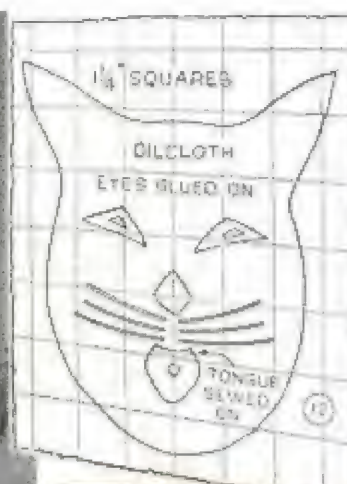
top and bottom, with cutouts, or with oilcloth flowers, as shown. Fig. 6 shows successive stages in making one kind of flower which is useful for a wide variety of applications. As applied to the waste basket, the six petals are wired together and then wired to the basket. Smaller petals cover the wiring, as can be seen in the center basket.

A surprising array of soft toys can be made from oilcloth. The elephant, Figs. 7, 8, 9, and 11, was made from red oilcloth with a pebbled surface; the dolphin, Fig. 10, from a pattern design. The elephant is bound with bias tape; the fish is simply sewed together





Window shades-can covers



String holder

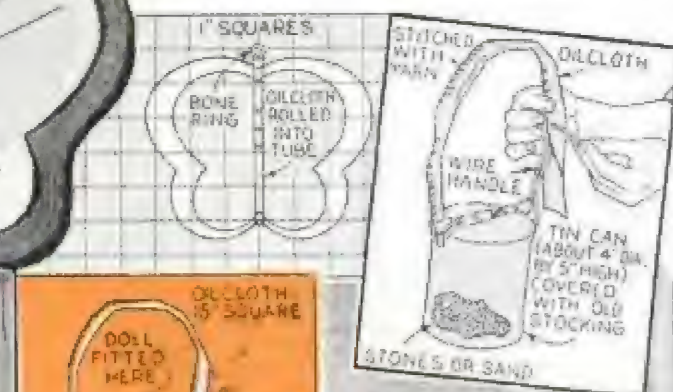


with exposed seams. Leave an opening at the top of the body for the insertion of the stuffing. Ears and fins are made double and are not stuffed. The eyes are cut from oilcloth.

Other novel and interesting applications of oilcloth are shown in Figs. 12 to 15 inclusive. The string holder, Fig. 12, is made from two pieces, the back piece being cut across to permit a ball of



Pot holder



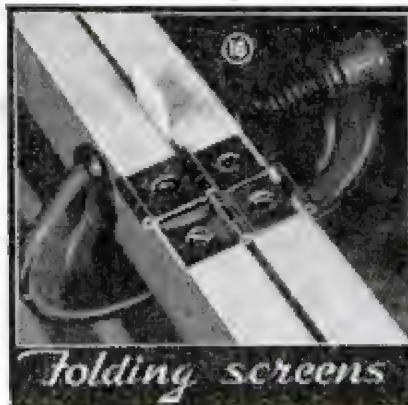
Book jackets



Doll door stops

string being placed inside. The string feeds through a hole under the cat's tongue. The pot holder is faced with oilcloth; the back is cloth. The doll door stop is easily made, using a tin can for a foundation, and a china or celluloid doll. Try oilcloth for book jackets, Fig. 14. The fabric can be pasted directly onto the cover or it can be made with pockets. Pebble, shot-grain and wave textures are ideal for this kind of work.

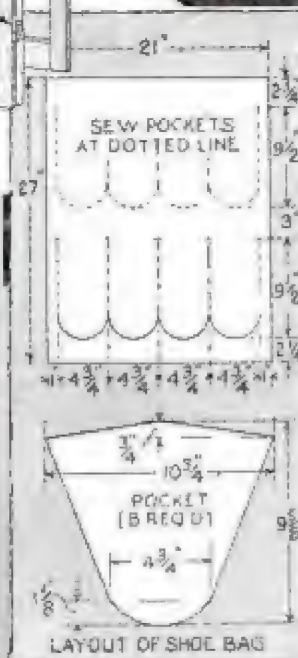
Folding screens made from oilcloth are colorful and inexpensive. They can be made in one, two, three or more panels. Dimensions for either a two or three-panel screen are given in the details, Fig. 17, each panel being covered with oilcloth. It is advisable to make and fit the entire wood framework first and then dismantle it so that each panel can be covered separately. In a two-panel screen the fabric can go right around both sides, tacking on the outside and capping with a



Folding screens



Shoe bag



wood strip or cloth binding. If the edge of the oilcloth is turned under it will finish nicely with large-headed upholsterers' tacks for fasteners. Hinges should be $\frac{3}{4}$ by $1\frac{3}{4}$ -in. double-acting type. Each fold of the screen will require three hinges. For a tight joint when the screen is opened flat, the hinges should be set in

hinge gains cut to a depth of exactly one-half the thickness of the hinge, Fig. 16. Everyone can use the attractive shoe bag, Fig. 18. Make it with a simple pattern design, binding with bias tape in contrasting color. The pockets are oversize, and should be pressed into place with a folded pleat on either side after the sewing is completed.

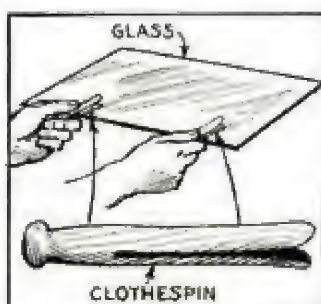
Washing Trays for Photo Prints Are Acidproof



These trays of hard-pressed board have no metal, which makes them both alkali and acidproof

Lightweight trays of hard-pressed board for washing photos are ideal for the amateur or for the small photo-finishing shop. Complete absence of metal in their construction makes the trays both acid and alkaliproof. Perforations in the bottom are made with a 1-in. auger, $\frac{3}{16}$ -in. holes being drilled through the sides near the lower edge for lacing the sides to the bottom. This is done with heavy cord, such as fishline. The sides are soaked in water for three days before making the trays to make them pliable so that they can be shaped around the bottom without breaking.—Jim Reynolds, Ames, Ia.

Clothespins for Handling Glass



Two or more clothespins are helpful when handling large sheets of glass, as they can be slipped over the edges to provide hand grips. Also, they are

helpful when handling large numbers of small sheets of glass. They can be used as forceps, the ends of the pins being pinched down on the glass on both sides.

—Dale R. Van Horn, Lincoln, Nebr.

Microscope Slide Is Marked to Tell Right Side

If you sometimes have trouble telling which side of a microscope slide is to be turned upward, make a shallow score across one corner as indicated. This can be done with a triangular file, taking care, of course, not to break the glass.



Adjustable Marking Gauge from Try Square

An adjustable try square or a miter square can be converted into a handy marking gauge by merely drilling a small hole in the outer end of the blade to take the pointed end of a lead pencil. The hole should center the half inch mark of the scale at the end. When adjusting the gauge, always allow $\frac{1}{2}$ in. more than you desire on account of the hole being drilled $\frac{1}{2}$ in. from the end.

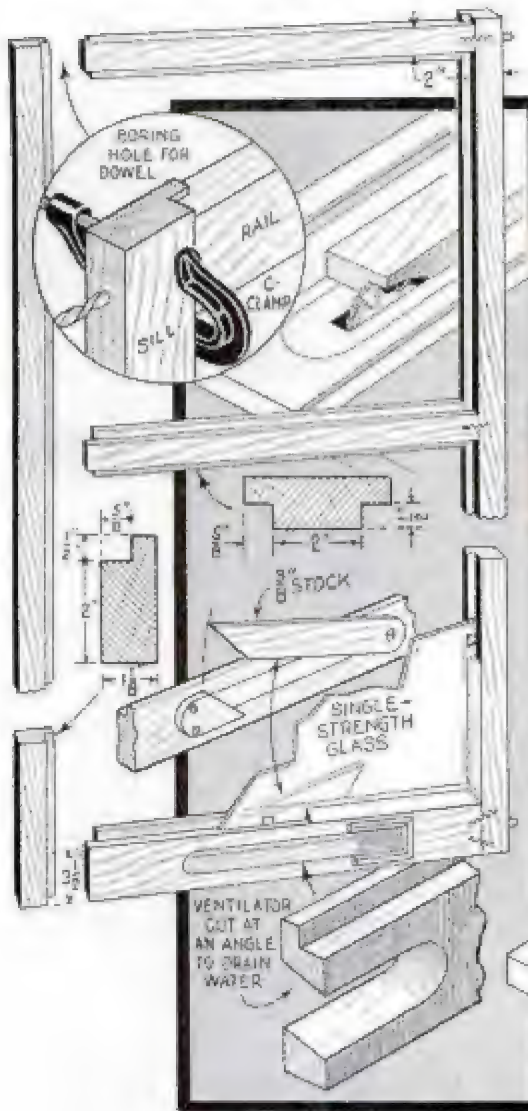
—Archie Amos, Fort Wayne, Ind.



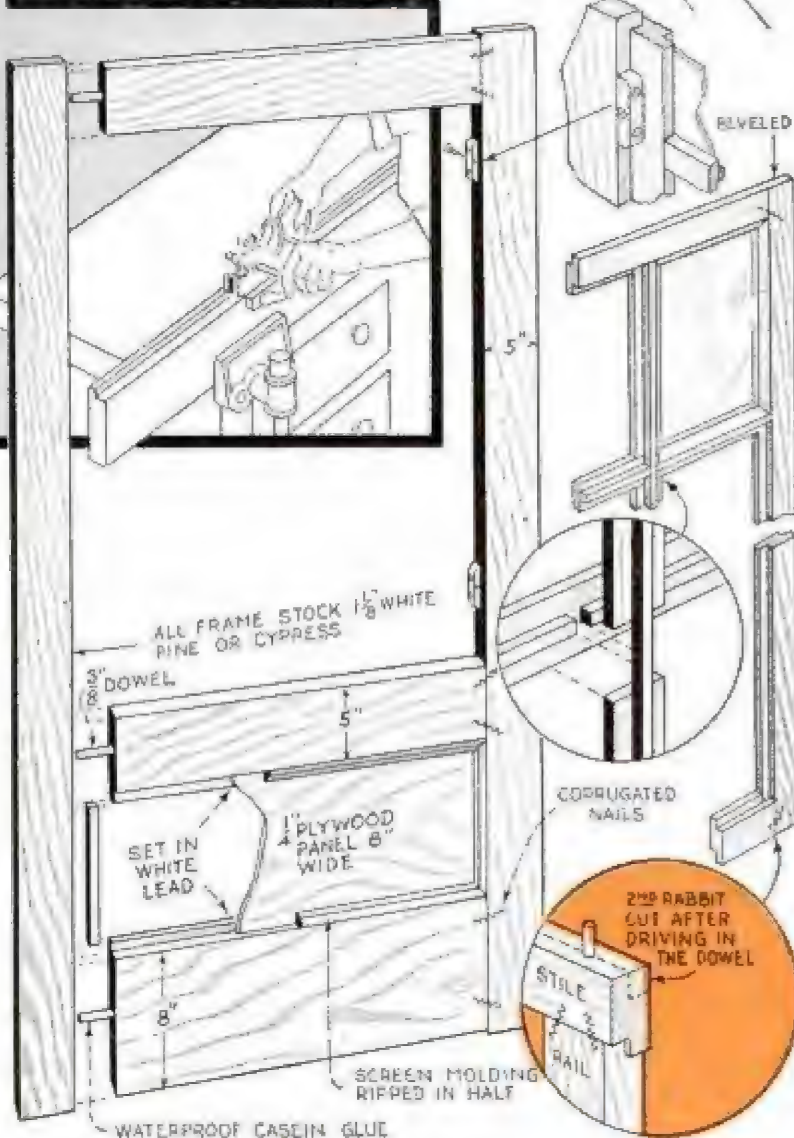
Small hole drilled near end of try-square blade converts it to marking gauge without damaging square

STORM SASH and DOORS

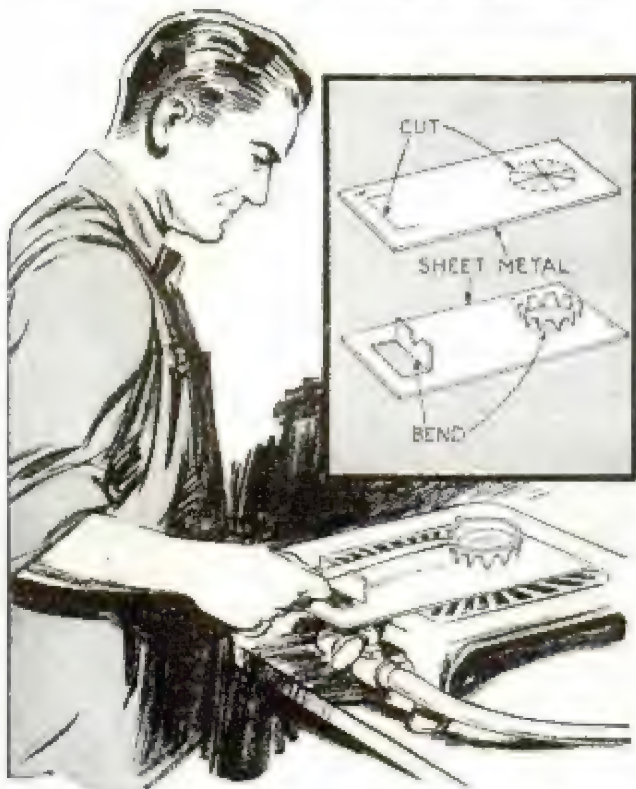
can be made at home



Although white pine is durable, works easily, and takes paint better, selected cypress is more lasting. Lacking power tools, a combination plane will take care of the necessary rabbeting. Stiles and rails of the doors can be joined with ordinary butt joints held with corrugated nails and stiffened with dowels as shown. Of course, when joining the sash frames you have to run the rabbet from end to end of the stile and rabbet the rails at each end to fit. To prevent joints of this type from absorbing moisture and opening up, coat both joining surfaces with white lead at the time of assembly. Use $\frac{3}{8}$ -in. corrugated nails on both sides of the joint and drive them at an angle so they do not split the stock. Sink the nails below the surface and cover with white-lead paste



Holder Keeps Ladle from Tipping While Heating on Gas Burner

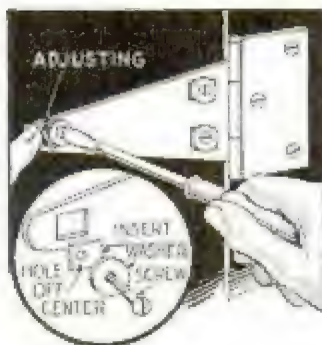


Severe burns caused by accidentally tipping a hot ladle of molten babbitt are prevented by this holder

Made from a piece of fairly heavy sheet metal, this holder can be placed on top of a burner to support your babbitt ladle. It is made by cutting out a circular portion of the metal near one end to form tabs to take the bowl of the ladle and cutting a notch at the other end, which is bent up to support the handle.

—A. H. Waychoff, Tempe, Ariz.

Adjustable Hinges for Large Doors Have Eccentric Screw Inserts



As heavy doors, such as those used on garages, have a tendency to sag and drag on the sills, which necessitates adjusting them frequently, it's a good idea to make the hinges adjustable. This

can be done by enlarging the screw holes and making them square to take square pieces of metal which are drilled off center to form an eccentric. In this way, the

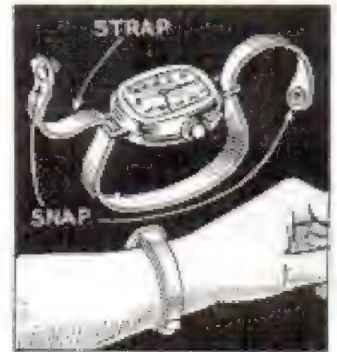
screws can be loosened and the square pieces of metal turned to either raise, lower or move the doors sideways.

—E. T. Gunderson, Jr., Humboldt, Ia.

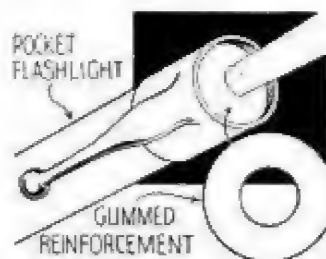
Snap Fastener on Wrist Watch Better Than Buckle

After accidentally dropping my wrist watch while trying to fasten the buckle on the strap, I substituted a snap fastener for the buckle. This allows me to put the watch on my wrist quite easily with one hand by merely bringing the ends of the strap together with the fingers and snapping the fastener.

—Don Henningfeld, Milwaukee, Wis.



Repairman's Pocket Spotlight from Pen Flash Lamp



Needing a strong, concentrated spot of light for trouble shooting, one serviceman obtained the desired effect by simply placing a gummed

reinforcement over the lens of his pen-type flashlight. The light rays passing through the opening in the center of the reinforcement are concentrated on the work in a tiny spot.

Rubber Heels Improve Ski Boots

If you are bothered by snow caking between your skis and your boot heels, tack a strip of rubber to the underside of each heel. You'll find that snow will not stick between the rubber heels and the rubber boot rests on the skis.—N. Cohen, Ste. Agathe Des Monts, Que., Can.

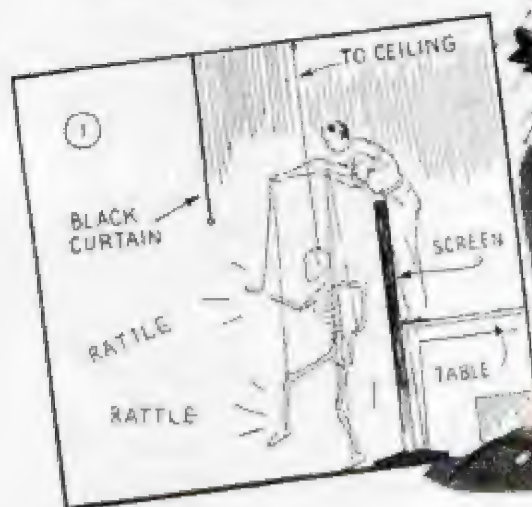


Backful of tricks for HALLOWEEN

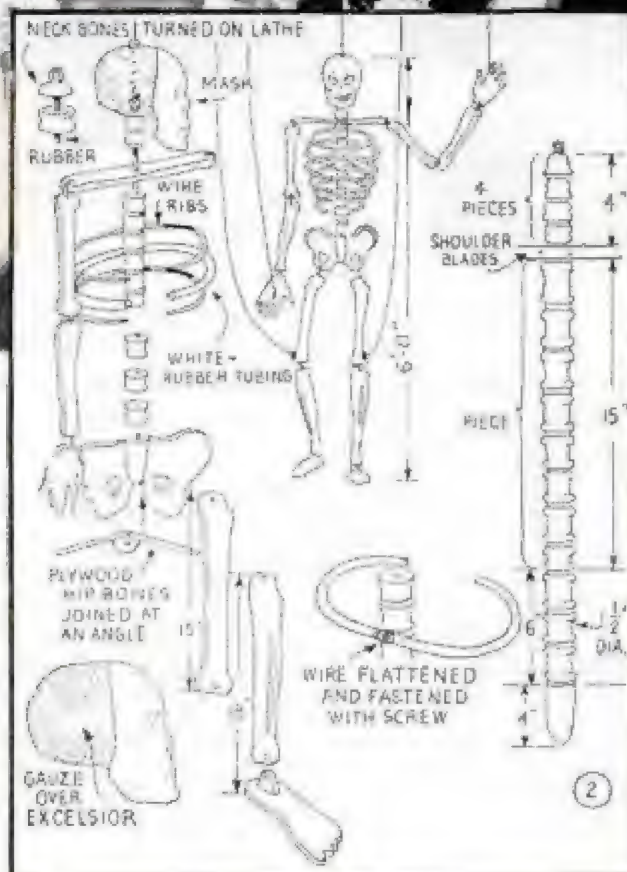
FUN-MAKING gadgets—eerie “spooks,” tricky games of skill, chairs that give the sitter a real thrill—all these you can make and set up in time for the party.

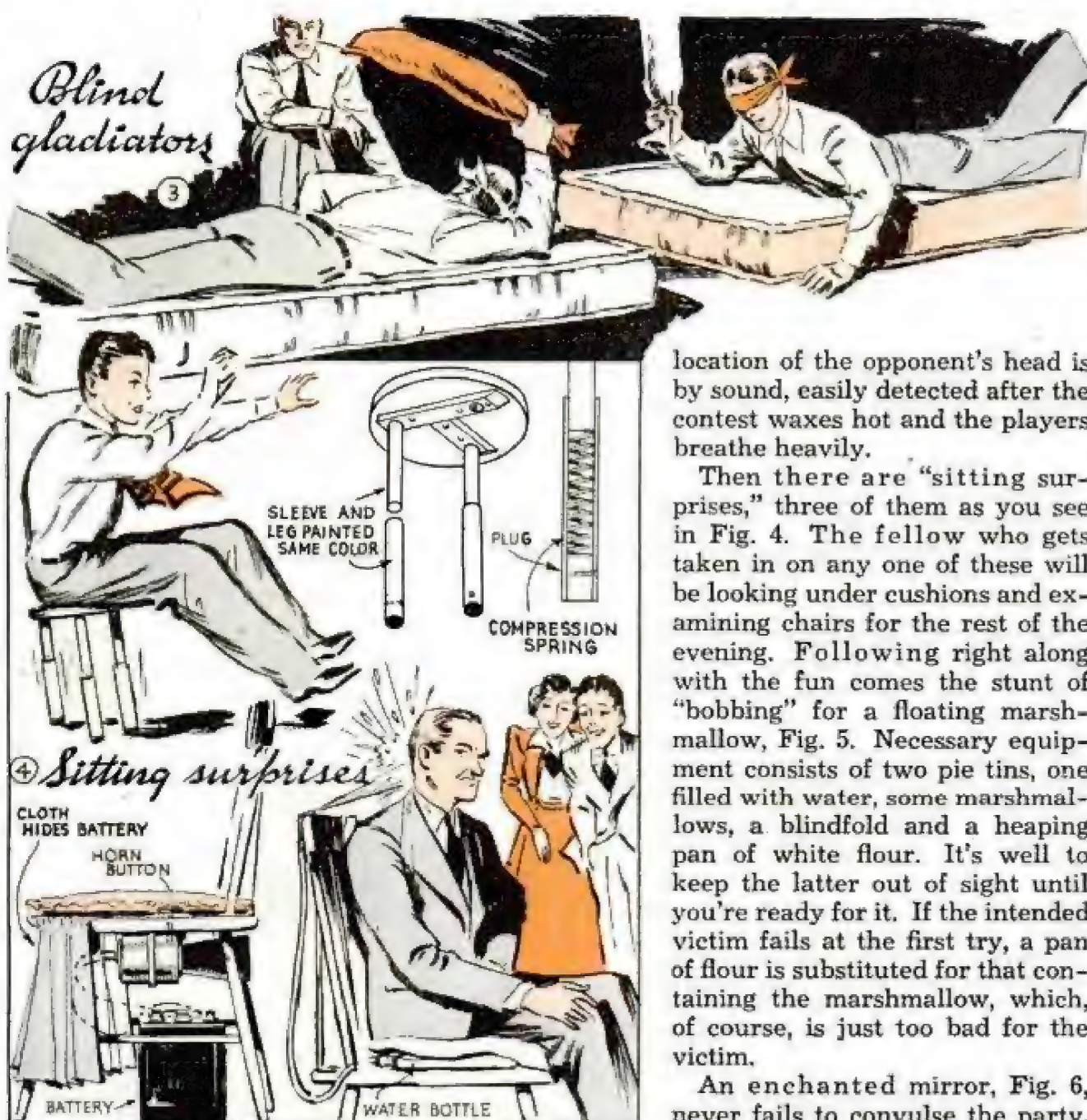
To begin with, a Halloween party is not complete without a rattly full-size skeleton. The one shown here is by no means correct anatomically, being short several ribs and a few miscellaneous bones, but your guests will forget all about being critical when it greets them at the door with a clatter. The skull is made of a

The rattling bones are upon you!



mask built out with excelsior and gauze, or a comical one can be painted directly on a gourd of suitable shape. A backbone of lathe-turned vertebrae is made semi-flexible by running a stout rubber cord through it. The section of backbone carrying the ribs is one piece and this as well as the other vertebrae and the hip bones are strung together on the rubber cord. This can be cut from a live inner tube. The plywood hip bones are joined at a 120° angle. Scrollsaw the leg and arm





bones from soft white pine, and to give them a semblance of the genuine article, smooth them up with a pocketknife and sandpaper. These are joined with soft, white cotton cord and should hang freely so they will swing about with the slightest agitation of the control threads as in Fig. 1. Hands and feet are of plywood as in Fig. 2. Paint the entire skeleton a flat white, or better, with luminous paint if available.

The battle of the blind gladiators, Fig. 3, affords plenty of fun—for the spectators. Two guests are blindfolded and lie prone on mattresses placed an arm's length apart, then, with cloth-filled stockings or other harmless cudgels try to wallop one another. The only way they can judge the

location of the opponent's head is by sound, easily detected after the contest waxes hot and the players breathe heavily.

Then there are "sitting surprises," three of them as you see in Fig. 4. The fellow who gets taken in on any one of these will be looking under cushions and examining chairs for the rest of the evening. Following right along with the fun comes the stunt of "bobbing" for a floating marshmallow, Fig. 5. Necessary equipment consists of two pie tins, one filled with water, some marshmallows, a blindfold and a heaping pan of white flour. It's well to keep the latter out of sight until you're ready for it. If the intended victim fails at the first try, a pan of flour is substituted for that containing the marshmallow, which, of course, is just too bad for the victim.

An enchanted mirror, Fig. 6, never fails to convulse the party.

Select a rectangular mirror, a cheap one, about 8 by 10 in., remove the wood molding and substitute a cardboard frame which has a profile cut out at one edge. This is merely to permit the mirror to be brought close to the face while shutting off the view from the back. The player cannot see his own reflection, but the guests look into the mirror at a low angle so that the side of the face is reflected into it, the two halves making a whole face. To keep the fun going, it's well not to tell the player what he makes himself look like when he rolls his eyes or twists his mouth.

Very little work is involved in making the "crazy table," Fig. 7. Since a cloth is to be used over it, no painting or finishing is required except the exposed part of the

legs. The entire top is supported by the center leg, with a crude ball-and-socket joint made as shown. This provides enough friction to maintain the top on a level plane until someone applies a little pressure, whereupon it tilts to that side to the consternation of the guests, especially after the plates start to slide, but only so far, because white threads stop them. The tumblers are held with rubber bands on adhesive tape. The entire bottoms of the tumblers should be covered with adhesive tape, to appear as the tablecloth.

Long-armed "Goonie" is shown in Fig. 8. He's just a costume, of course, but inside him is one member of the party who is going to have a lot of fun. Making the hat of pasteboard is a simple scissors-and-glue job. Eyeholes are cut to fit and covered on the inside with gauze stained black. A heavy black hat band will be effective. For the collar an old stiff shirt bosom is just the thing. White bristol board can be used, but must be reinforced at the collar but-





tons with cloth glued on. The coat is a long-sleeved cape-like affair and should be green, orange, or other bright color with large, white cardboard buttons. Make the lower sole of the shoe larger than the inner one, so that the rim extends all around. Paint it yellow. The pincers are

of wood, made and operated as shown. A tube of wire fly-screen fills out the forearm to the proper size and a white cotton glove is pulled over the pincers. When at last it's time to eat, this part of the outfit can be discarded and the long sleeves rolled up.

The "follow-the-string" stunt requires some preparation beforehand but it's a good one to have up your sleeve if you're master of ceremonies. Generally it should be one of the first stunts on the program, so as to clear the house of strings for other events. Several colors of twine are used, as in Fig. 9.

Start one at a time, beginning near the entrance where guests will assemble. Run the string along the base of the walls, fastening it with tacks or adhesive tape at the turns, lead it around deviously, upstairs and down if you wish, finally ending up at some such place as the sink. Start another color at the beginning place and



lead it around to another destination, and so on, one color or quality of string for each male guest. On the night of the party the girls draw cuts for envelopes with secret instructions. They open the envelopes privately and are ordered to go, for example, to the sink, or to sit on a trunk in the attic, or to the coal bin, and so on. They then depart for their stations without revealing them. Next, the boys draw cuts for the strings, and when allotted, each follows his color, winding up the string as he goes and taking care not to tangle up others. Eventually he comes to the end and finds a partner. She hands him a sealed envelope with instructions—perhaps to fill the coal hod, move the trunk, wash the dishes, sweep up crumbs under the table, or some other task.

Another fellow who is sure to contribute his bit to the fun is "Mr. Buzzer," who is thoroughly frightened with himself and looks it. Unless you are an electrician you will find it difficult to guess what is physiologically the matter with him when he shows up at the party. He can scarcely

move without an ominous buzz or a clattering, unmusical ringing of bells. Of course, Fig. 10 spreads the whole secret before your eyes. Operated as it is with dry cells, there is no danger or discomfort with this costume, and it is a simple matter to rig the contacts and string the wires.

Messages, orders and strictly secret instructions should be put up in imposing envelopes along with a paper "beetle" as shown in Fig. 11. The one who receives the message gets something of a start when he opens the envelope. Of course, the "beetle" is expected to jump out and flap

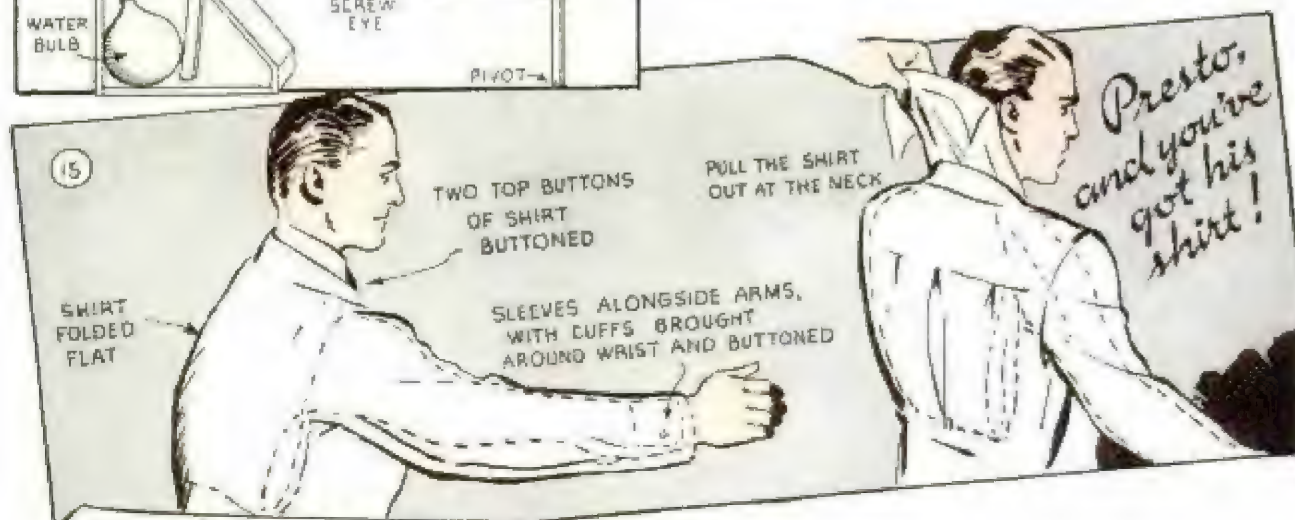
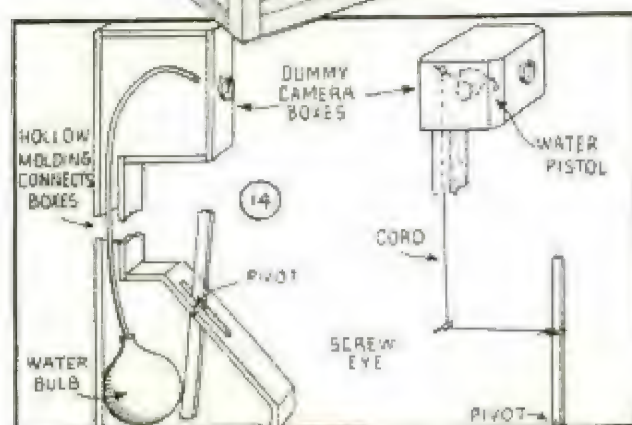


Bottle archery

(12)



*Kibitzer shoots self
at photo booth*

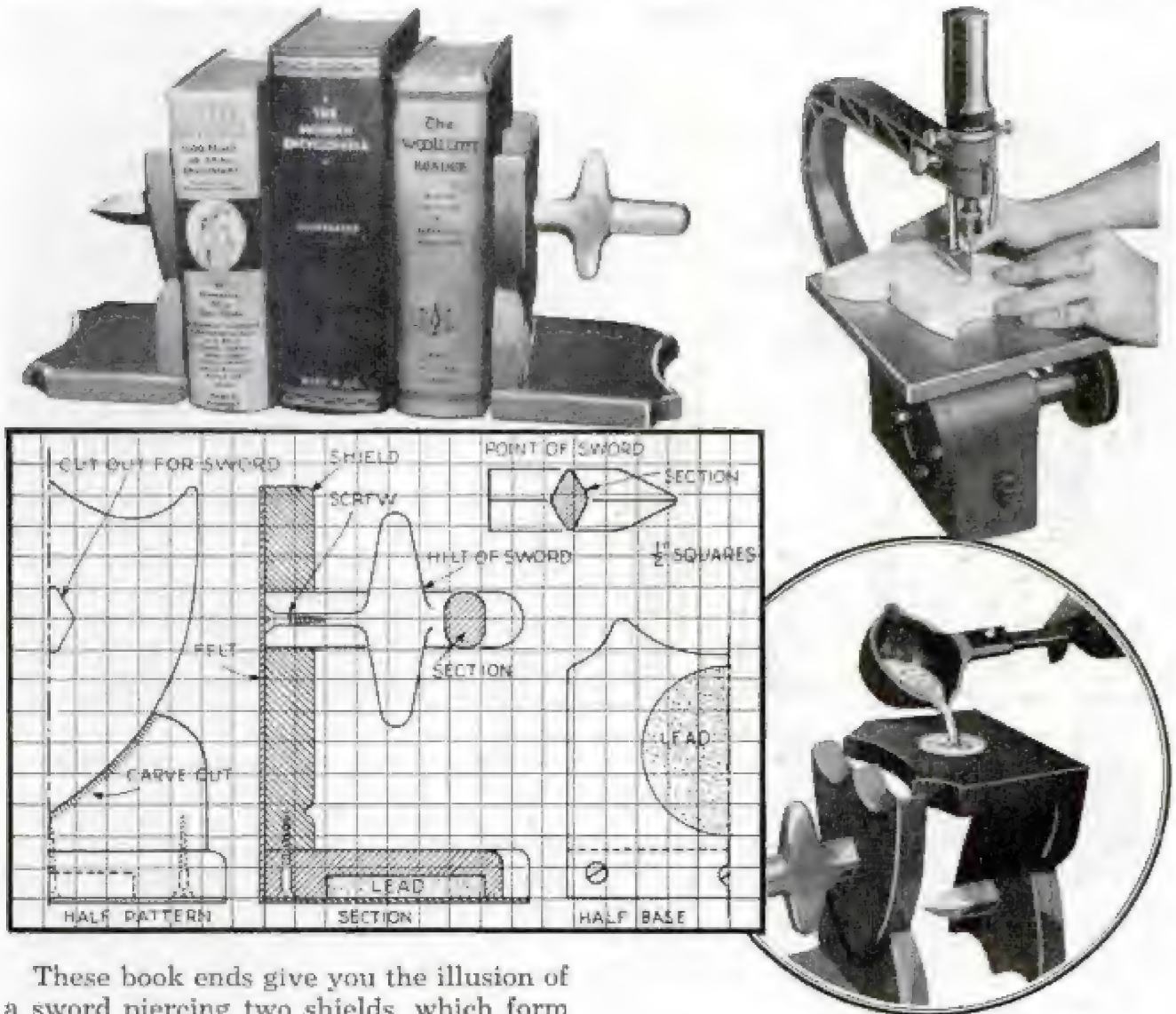


his wings and that he generally does. Now then, when things show signs of lagging a bit, there's "bottle archery," Fig. 12. It looks easy—until you try it. Old-style round-head clothespins are used as "arrows." Each player gets five trials with five pins. The winner is he who drops the greatest number of pins into the bottle. A small but coveted prize will produce knitted brows and considerable concentration on the part of the players before they tire of this.

Figs. 13 and 14 show one especially for the fellow who always likes to know how things work. The sign, you see, is what tempts him. The whole thing is a fake photo booth, and the warning sign is purposely "planted" to catch the unwary. The meddler naturally wants to be the one to take the "picture," and, if you're careful with the constructional details, Fig. 14, he usually does it as shown. Of course, there'll be a laugh around at his expense. Now, just before the curtain drops, you might literally pull the one shown in Fig. 15. The subject, of course,

must be a willing one and must, moreover, volunteer his services. He goes through the evening waiting for his cue and no one is the wiser. But, just at the dramatic moment you suddenly seize his shirt collar when every one happens to be looking. One sweeping jerk and there's his shirt, right out in plain sight. People will hold their breath and look blank, wondering what's coming next. But that's all.

Sword on Book Ends "Pierces" the Volumes



These book ends give you the illusion of a sword piercing two shields, which form the vertical book supports, and also the volumes held between them. The squared detail gives you the sizes and shapes of the various pieces, which are cut from $\frac{3}{4}$ -in. hardwood. The two sword pieces are mortised and glued into the shields, a wood screw being driven into the end of each. Holes $2\frac{1}{2}$ in. in diameter are drilled part way through the bases. Then small nails are driven into the wood so that the heads will project in the recess to securely anchor lead which is poured in to serve as a weight. After this the underside of each book end is covered with felt.

☞ Removing lint from garments with a bristle brush or broom often creates static electricity which only serves to make the lint cling more stubbornly. If a damp rubber sponge is first rubbed over the fabric, the lint strands will roll into little pellets which may be brushed away easily.

Wrist Pincushion Saves Time

Why bother with a pin tray, which is never just where you want it while sewing, when this wrist cushion will keep pins right where you can reach them easily? It consists of a small pincushion attached to a wrist band, which is made from a piece of clock spring or spring brass. The cushion is attached either by drilling two small holes in the band to stitch it in place, or by inserting the band into a tight-fitting sleeve sewed on the underside of the cushion.

—W. W. Wheatly, Lakeside, Calif.



This Sack Holder of Angle Iron Is Adjustable to Any Size



This holder has no holding prongs or teeth to tear the cloth when inserted into a sack

Here's a sack holder that is quickly adjusted to fit in the mouth of any sack and hold it taut. Horizontal arms riveted across the lower ends of two vertical pieces, which are bent as indicated and pivoted at the upper ends, fit inside the sack mouth. A third piece, pivoted to one of the vertical irons, has teeth cut in the lower side to engage the end of a slit made in the other vertical piece. By pushing this arm the vertical pieces are spread to draw the sack mouth taut.

—A. S. Wurz, Jr., Rockyford, Alta., Can.

Wet Paint Brushes Preserved in "Cellophane"



Cellophane when they are not in use. The brushes should be well filled with paint

Trouble and expense of cleaning paint brushes, when they are used from day to day to apply the same color paint, may be spared by simply keeping them wrapped in

before putting them away. If clean, dry brushes are kept wrapped in Cellophane, they will always be free of dust.

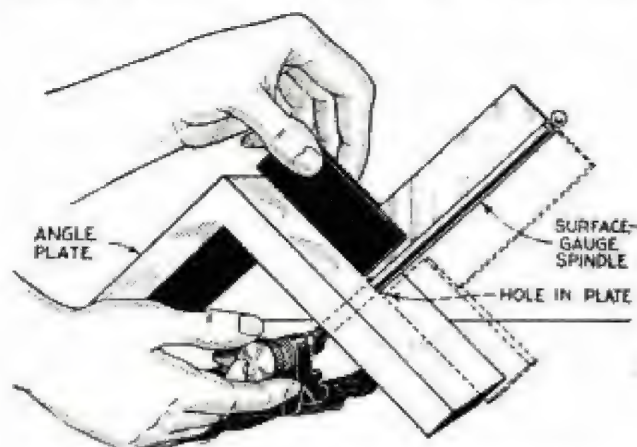
—Edgar L. Brokaw, New York City.

Overflow-Pipe Connection on Drinking-Water Tanks

On any reservoir containing drinking water, the overflow pipe, if the tank has such, should not be connected to a waste drain, especially one leading to a septic tank, on account of the potential danger of drinking-water pollution. Always run such an overflow pipe out of the building where it can drain in the open. In the article describing the design and construction of hydraulic rams, published in our August and September issues, the error was made in Fig. 4, of showing the overflow of the water reservoir connected to the sink drain below. If the water in the tank is to be used for drinking purposes, it is advisable to change the overflow connection.

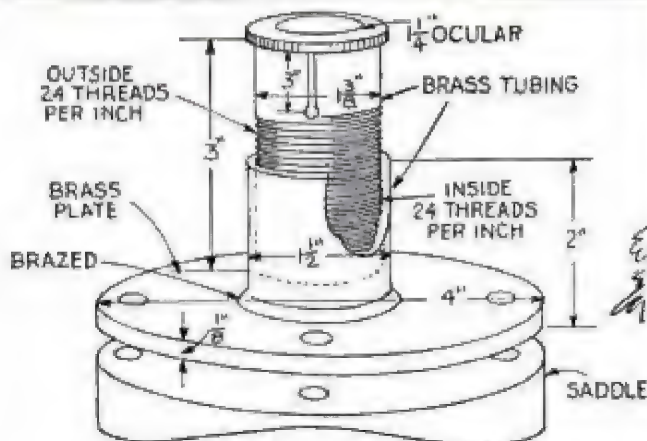
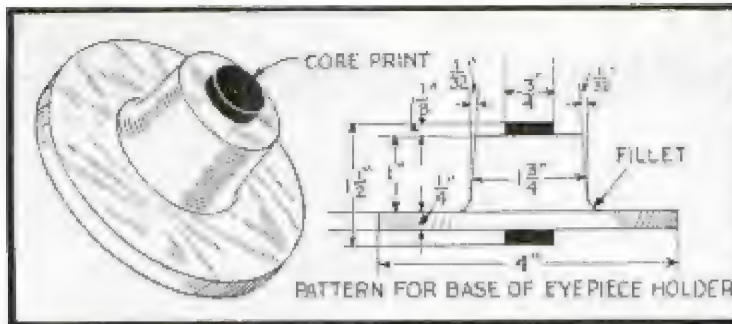
Easy Way to Test a Square

To test the trueness of a carpenter's square, an ordinary angle plate and a surface gauge may be used, provided they are in good condition. Lay the angle plate down as shown, and pass the surface-gauge spindle through one of the bolt



Any inaccuracy in a square is readily shown by making this test with a surface gauge and an angle plate

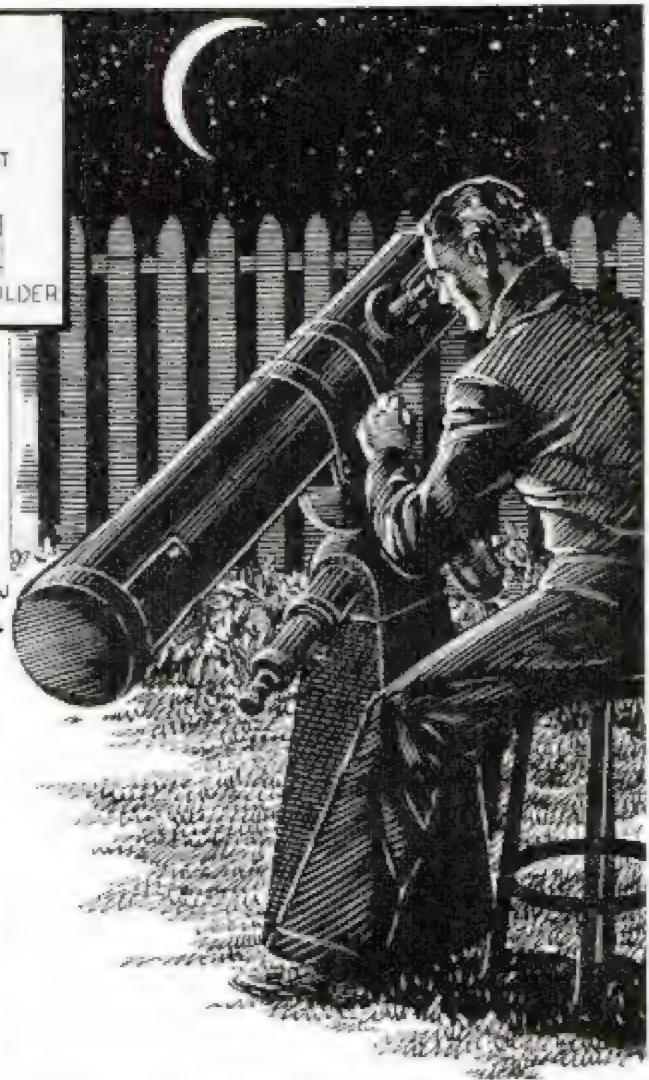
holes. Then, with the square to be tested touching it, adjust the spindle until no light shows between, or until two pieces of cigarette paper can be nipped between. The square is then placed on the opposite side of the spindle and the extent and location of the error, if any, will be seen.



When you train your reflecting telescope on the heavens in search of some particular celestial object, it's worth something to have an accurate "slow-motion" adjustment of the eyepiece or ocular. While ready-made holders of the rack-and-pinion type are preferable, here's the next best thing at a fraction of the cost. As you will see, there are really two suggestions in the details. In one, the holder consists of two short lengths of brass tubing, threaded inside and outside, the outer one being brazed to a $\frac{1}{8}$ -in. brass disk, which is bolted to the saddle. Another way, shown in the upper detail, is to make a pattern of the lower half of the holder, have this cast in brass, then machine it all over and thread it to take the sleeve which holds the ocular. Note that the latter is slotted at the upper end to give some spring so that it will hold the eyepiece firmly.

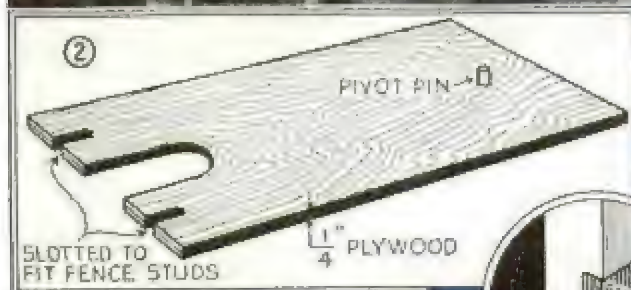
Disinfectant for Spraying

A spray solution that will kill lice and fleas in poultry houses as well as destroy offensive odors and disinfect garbage cans, outbuildings and other sources of decay is made from pine oil, rosin, lye and water. The concentrated disinfectant from which the spray is made by diluting with water,



is produced by heating together steam-distilled pine oil, 5 lbs., and water white wood rosin, 2 lbs., in a kettle, preferably over a water bath. The heating should be watched carefully so that the temperature of the mixture does not get higher than 176° Fahr. While heating, the mixture should be stirred constantly. Heating and stirring are continued until the rosin has melted and mixed to an even, oily consistency. As this mixture will burn, care should be taken to prevent fire. When dissolved, it is allowed to cool to 140° Fahr. At this temperature, 1 pt. of lye solution, made by dissolving high-test lye, 1 lb., in water, 3 pts., is added slowly while stirring gently. When the lye has all been added, the heat should be regulated to keep the mixture at about 140° Fahr. for a half hour. During this time it should be stirred slowly. As a wash for deodorizing and disinfecting, one part of the concentrated disinfectant is stirred into water, 40 parts.

Extra STORAGE SPACE in

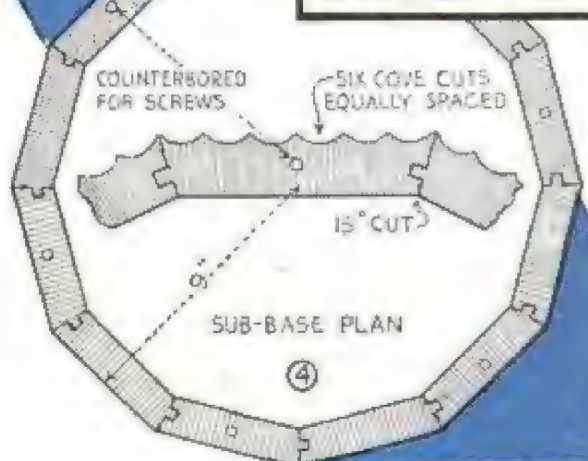
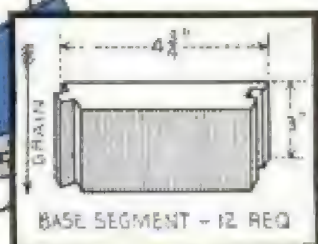
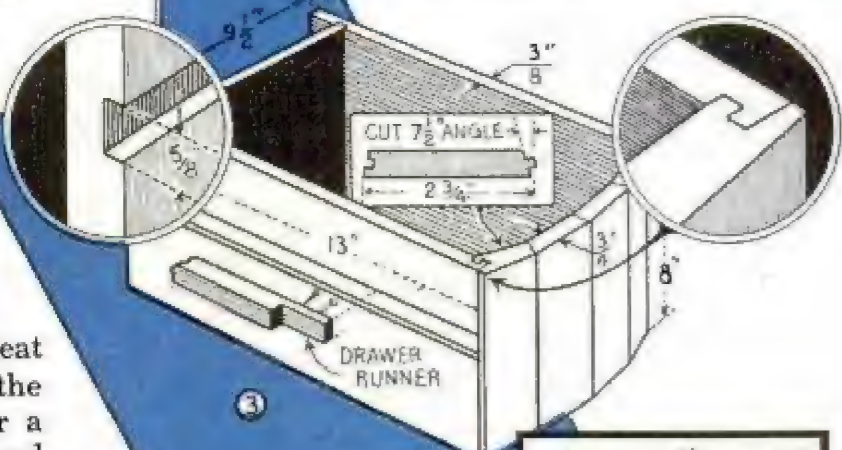


By
WAYNE C. LECKEY

THE ROUND upholstered seat of the costumer shown at the extreme right is formed over a drum-shaped frame of plywood and wallboard, details of which are given in Figs. 7, 8, and 10. Two 20-in. disks of $\frac{1}{2}$ -in. plywood are cut perfectly round and rabbeted on the shaper as shown in Figs. 1 and 2, utilizing a simple jig to revolve the work past the cutter. Uprights of scrap stock which form the framework of the drawer opening and the rear-joint member are nailed between the two disks. Fig. 11 shows how a strip of wallboard is nailed around the rabbets after which the opening for the drawer is cut out flush with the frame. A 2-in. hole for a chromium-plated column is bored through the disk and fitted with a counter-bored block glued and screwed directly below to anchor the column to the seat.

A single drawer, dimensioned in Fig. 3, is grooved to slide on two $\frac{5}{8}$ -in. runners.

These are nailed in place at the front and through the cardboard at the back and should be fitted to provide free movement of the drawer in the opening. The front is curved to conform with the seat by gluing several angle-cut segments together as shown in Fig. 5. A groove for the plywood drawer bottom is cut in each segment before gluing. Rounding the front of the drawer to conform to the curve of the seat may be done with a sanding block. Fig. 8 shows the layout for the drawer grille which is jigsawed from thin plywood or fiber board to overlap the drawer opening. This is curved by attaching with screws over a back-

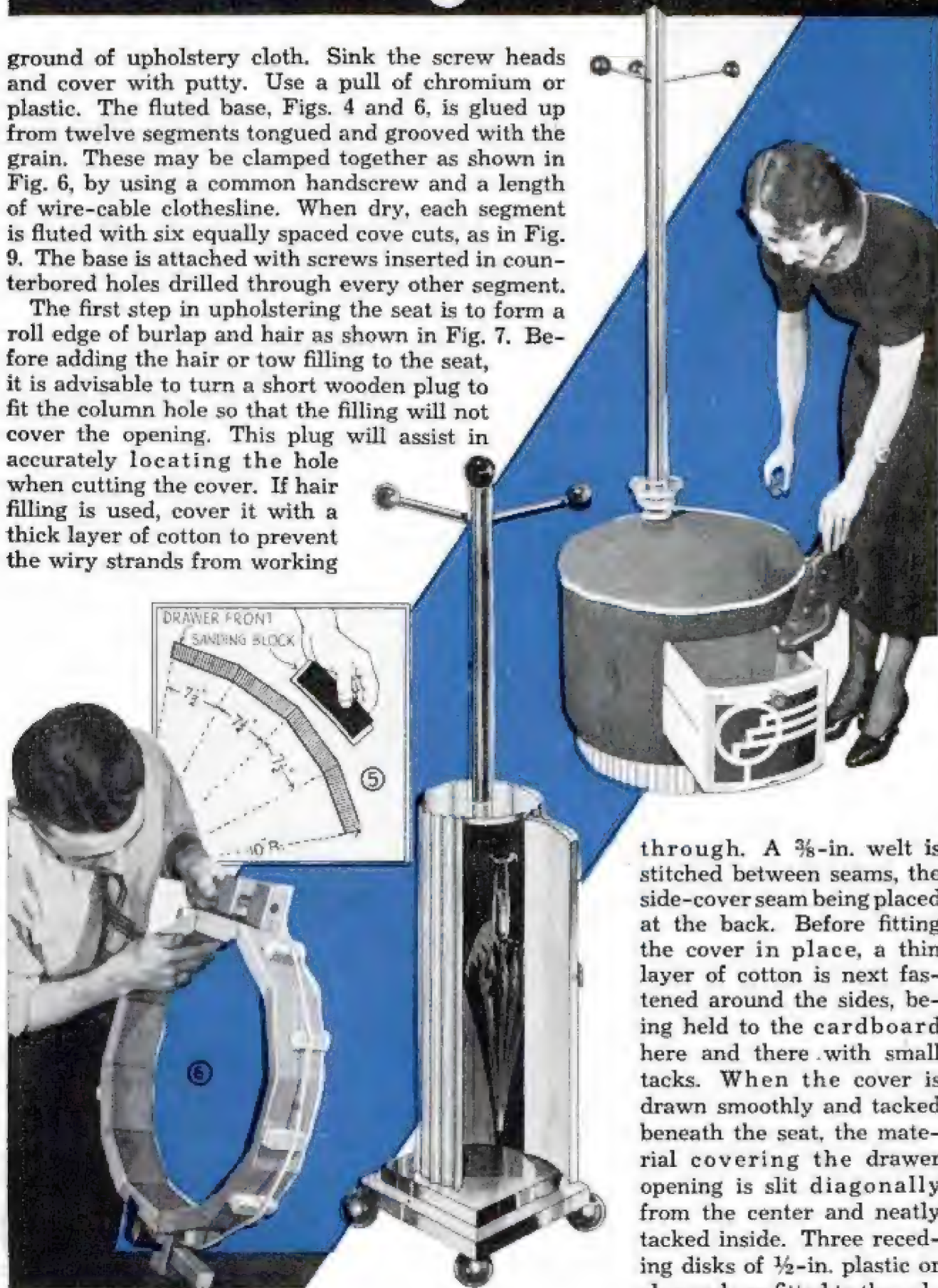


these Smart COSTUMERS

ground of upholstery cloth. Sink the screw heads and cover with putty. Use a pull of chromium or plastic. The fluted base, Figs. 4 and 6, is glued up from twelve segments tongued and grooved with the grain. These may be clamped together as shown in Fig. 6, by using a common handcrew and a length of wire-cable clothesline. When dry, each segment is fluted with six equally spaced cove cuts, as in Fig. 9. The base is attached with screws inserted in counterbored holes drilled through every other segment.

The first step in upholstering the seat is to form a roll edge of burlap and hair as shown in Fig. 7. Before adding the hair or tow filling to the seat, it is advisable to turn a short wooden plug to fit the column hole so that the filling will not cover the opening. This plug will assist in accurately locating the hole when cutting the cover. If hair filling is used, cover it with a thick layer of cotton to prevent the wiry strands from working

through. A $\frac{3}{8}$ -in. welt is stitched between seams, the side-cover seam being placed at the back. Before fitting the cover in place, a thin layer of cotton is next fastened around the sides, being held to the cardboard here and there with small tacks. When the cover is drawn smoothly and tacked beneath the seat, the material covering the drawer opening is slit diagonally from the center and neatly tacked inside. Three receding disks of $\frac{1}{2}$ -in. plastic or plywood are fitted to the col-

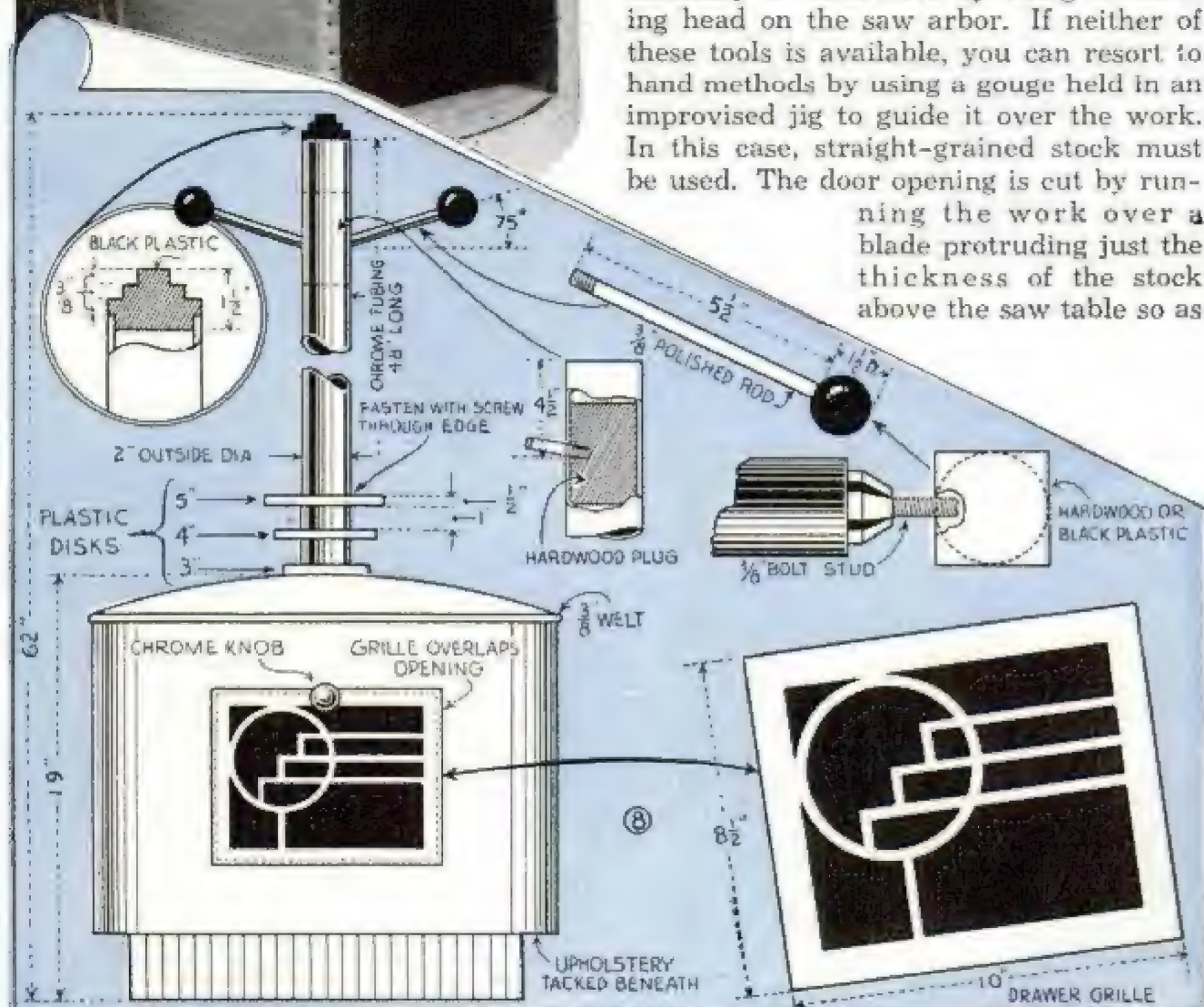




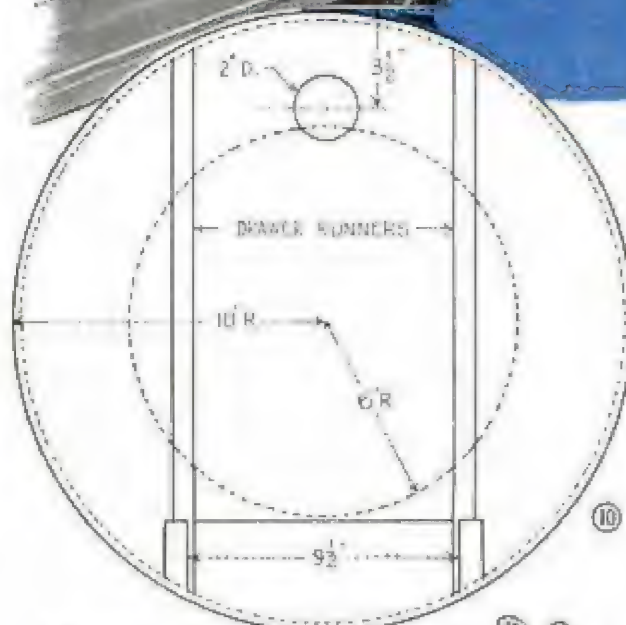
umn where it rises from the seat to conceal the raw edge of the covering. The upper end of the column is plugged with hardwood and drilled for the three ball-tipped arms. Note that one end of each rod is threaded. If need be, a hardwood jig made to guide the bit at the proper angle will aid in drilling all holes alike. Holes slightly undersize will permit the arms to be threaded into the wood. The top is capped with a plastic ornament as shown.

The second costumer shown at the right of Fig. 6 offers storage space for umbrellas and rubber footwear. The fluted pedestal is formed of twelve segments splined or tongued and grooved as in Fig. 12. One end is fitted with a top bored to receive the short chromium column. Fitting this top piece can be done most accurately by standing the assembled pedestal on end and transferring the shape to the work by marking around the inside. To flute the column, you can either use the shaper to flute each segment separately before final assembly or afterward by using a molding head on the saw arbor. If neither of these tools is available, you can resort to hand methods by using a gouge held in an improvised jig to guide it over the work. In this case, straight-grained stock must be used. The door opening is cut by run-

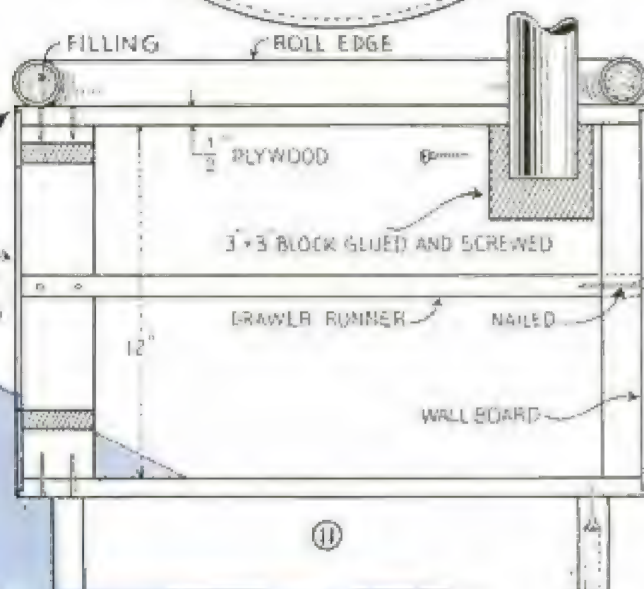
ning the work over a blade protruding just the thickness of the stock above the saw table so as

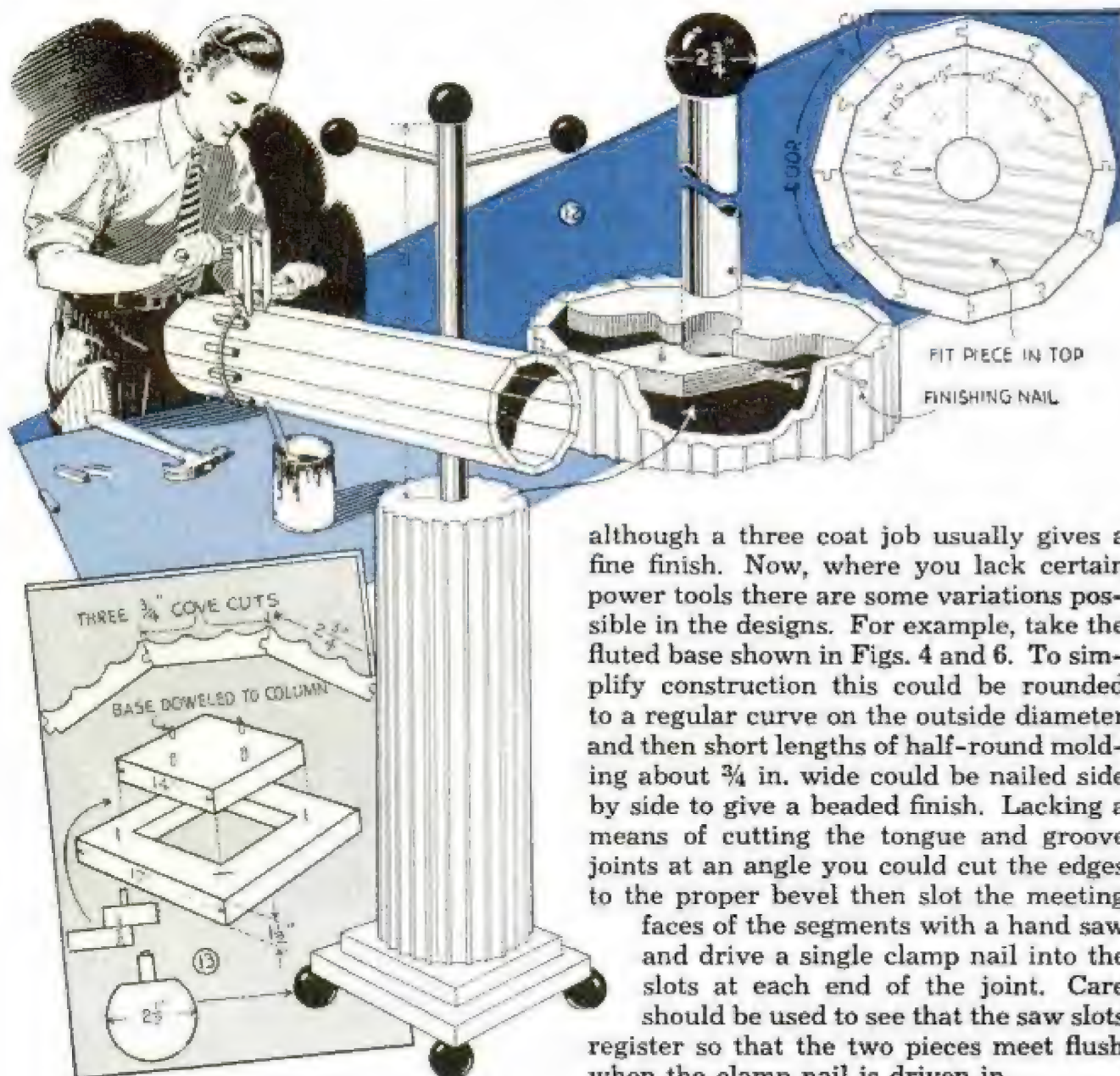


not to cut into the top piece. The saw cuts on each side of the door can be evened up by adjusting the setting of the hinges. The pedestal is attached with dowels to an offset base of thick blocks, Fig. 13, the lower one of which is built up from narrow stock mitered at the corners. Corrugated fasteners may be used to strengthen the joints. Four turned ball feet are attached to the corners of the base with dowels and glue. The chromium tube is fastened by embedding the lower end into a counterbored block into each end of which a screw is driven through the side of the pedestal, Fig. 12. Similar type arms are used for hangers as shown in the other design although a ball-shaped plug of hardwood or plastic may be used to cap the end. All parts made of wood and exposed to view should be finished with several coats of bone-white enamel. As is true of most all finishes, a fine enamel finish likewise is the result of thoroughness both in preparing the surface and applying the finish. All surface irregularities should be removed by sanding with progressively finer papers, using No. 00 last. After dusting the work clean, apply a coat of enamel undercoater using a clean, soft-haired brush. Thin this slightly so that it will penetrate the wood more deeply. Allow 24 hrs. to dry and then rub down smoothly with fine steel wool. Dust clean again before applying the second coat, which consists of a mixture of equal parts of undercoater and enamel. When this has dried for 48 hrs., rub smooth, and apply a final coat as it comes from the can. An additional coat may be applied, if desired,



8 x 9 1/2
OPENING



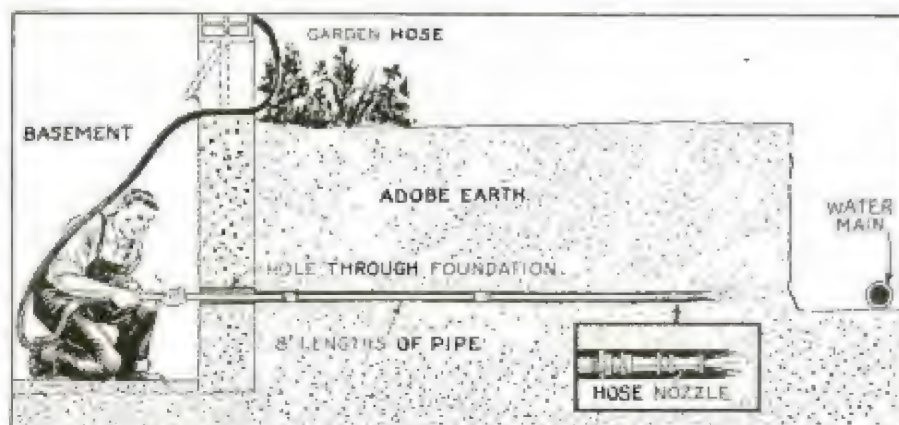


although a three coat job usually gives a fine finish. Now, where you lack certain power tools there are some variations possible in the designs. For example, take the fluted base shown in Figs. 4 and 6. To simplify construction this could be rounded to a regular curve on the outside diameter and then short lengths of half-round molding about $\frac{3}{4}$ in. wide could be nailed side by side to give a beaded finish. Lacking a means of cutting the tongue and groove joints at an angle you could cut the edges to the proper bevel then slot the meeting faces of the segments with a hand saw and drive a single clamp nail into the slots at each end of the joint. Care should be used to see that the saw slots register so that the two pieces meet flush when the clamp nail is driven in.

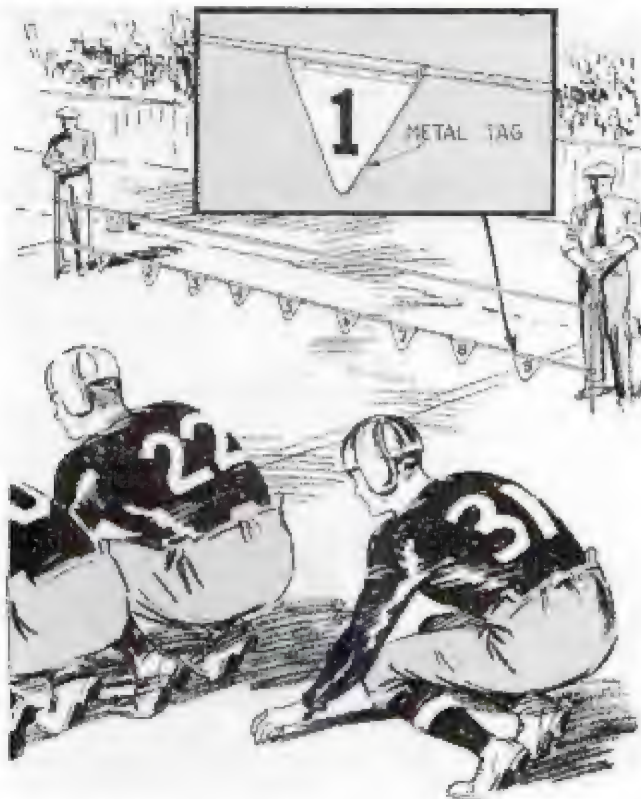
Hole Is "Dug" Hydraulically Underground to Lay Pipe

Desiring to run a water line into my basement from a water main at the sidewalk without disturbing my lawn, I found that it could be done hydraulically. After determining the depth of the water main at the sidewalk I drilled a hole through the basement wall at the same level, through which I inserted the nozzle of my garden hose and turned on the water. As the latter slowly washed away the soil the nozzle was removed from the hose and screwed to the end of a piece of

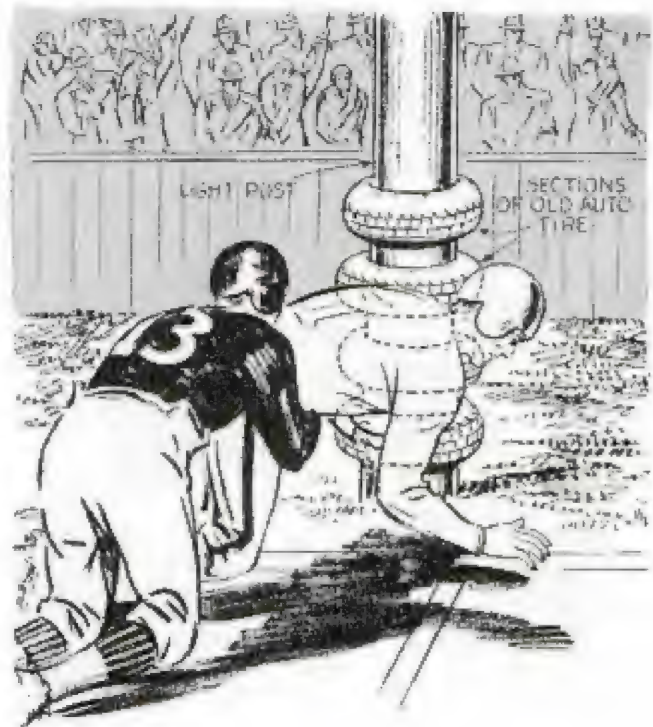
pipe, using an adapter. By slowly adding short pieces of pipe as the hole progressed I soon had the hole straight through to the main. —Robert E. Toms, Riverside, Calif.



Marker and Guard Used on Football Fields



To help avoid disputes in determining distance on a close play in a football game, the linesmen at one field have their 10-yard marker laid off in yards as shown in the left-hand detail. This is done by means of triangular metal tags clamped over the marker chain at 3-ft. intervals. At another

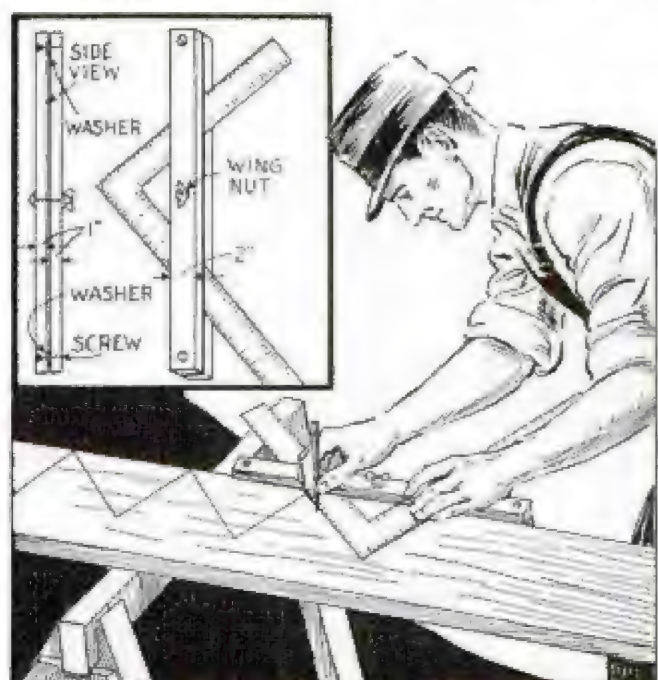


field where games are played at night under artificial lighting, the poles supporting lamps are padded with old auto casings to help prevent injury to the players. The beads are removed from the casings, which are then cut into sections and nailed to the sides of the posts facing the field.

Jig for Laying Out Stair Steps to Space the Treads Evenly

If you are going to make a stairway or build some porch steps here's a jig to use on a square that will enable you to mark off and space the treads accurately. It consists of two wood strips held together at the ends by small bolts or screws, the strips being spaced with a couple of washers. In use, the square is slipped between the wood strips as indicated, where it is held by a small bolt and wing nut, which clamps the strips tightly against the square. Adjust the jig on the square for the first tread accurately and then proceed to mark out the remaining treads by merely sliding the square and jig along the side of the step rails as shown in the drawing.

☛ To prevent drafts under doors use a sand bag the length of the door. A slip cover of bright chintz with a ruffled flounce will improve its appearance.



With this jig attached to a carpenter's square, anyone can easily lay out the steps for a stairway

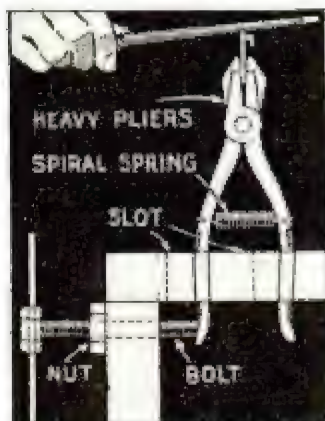
Piece of Plate Glass and Steel Ball Make Two-Way Level



Tables and large flat surfaces, leveled in all directions, with glass and steel ball

To level a billiard table or a piece of machinery in all directions at once, a sheet of plate glass should be laid flat on it. Then by means of a steel ball of the kind used in bearings, you can note the low spot by observing in which direction the ball moves. This system is often used to level up wheel aliners as these machines must be level in all directions.

Small Vise from Pair of Pliers



top near one of the legs where a screw passing through one of them contacts the nearest handle to serve as a vise screw.

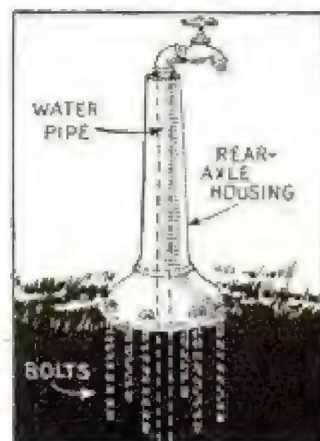
The home mechanic who often finds himself in need of a tiny vise and doesn't have one at hand, can improvise one quickly from a pair of heavy pliers. The handles are inserted in holes drilled through a bench

The handle contacting the screw, of course, must work in a slot in the bench top, while the other handle of the pliers is fastened rigidly in its hole.

—L. B. Robbins, Harwich, Mass.

Exposed Lawn Hydrant Is Housed in Rear-Axle Housing

If you have a hydrant in your lawn, the pipe can be protected against accidental breakage by enclosing it in one half of an auto rear-axle housing. The bell end of the housing is placed next to the ground and long slender bolts or rods are driven through the bolt holes into the soil to support it.



Turnbuckle Serves as Tap Wrench

In an emergency a turnbuckle can be used to turn a small tap. The shouldered end of the tap is inserted between the ends of the two screws of the buckle, after which they are turned tightly against it. If the ends of the screws are rounded slightly, it may be necessary to square them with a file or on a grinding wheel.

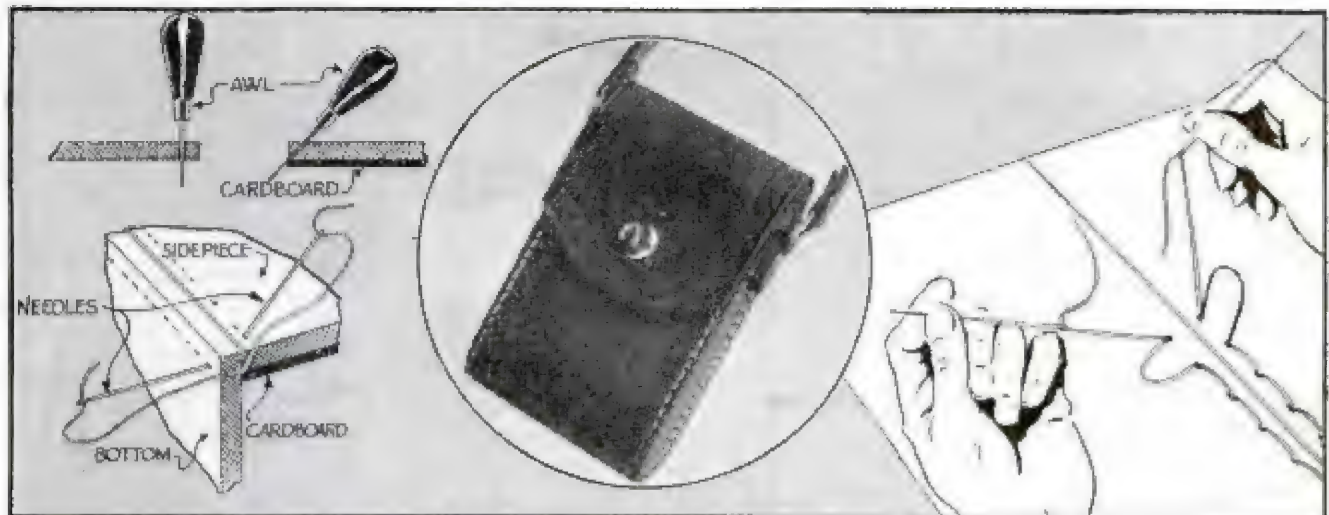
—W. C. Wilhite, Carlinville, Ill.



Photographic Inventories

If you carry insurance on tools, business equipment or hobby collections, it's a good idea to keep photographic inventories of them to serve as a reminder in making out a claim for insurance in case of fire. The inventories may be made quickly with almost any camera capable of taking time exposures. If good negatives are produced, enlargements of any needed size can be made on short notice.

Make a Leather Case to Carry Your Camera

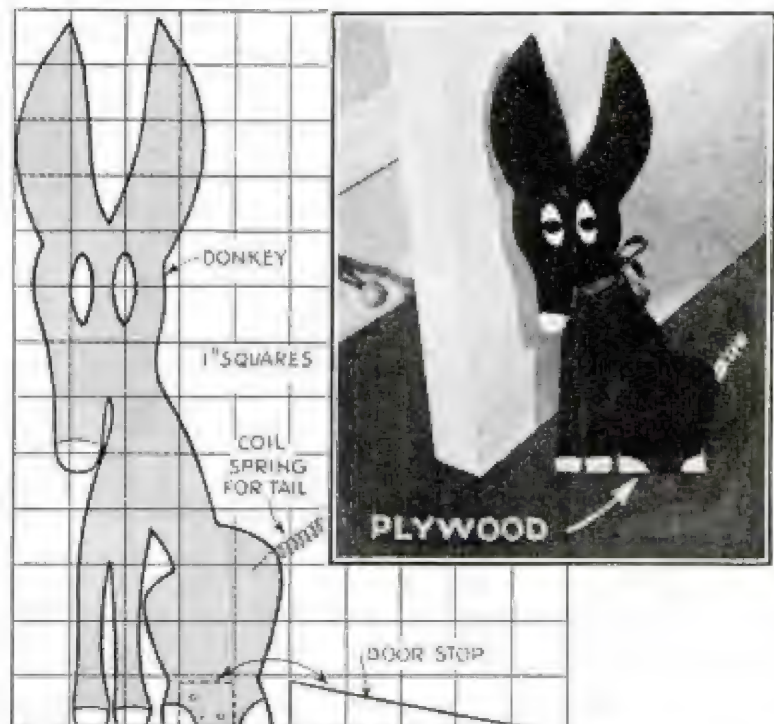


It's no trick to make an attractive carrying case for your camera that will last indefinitely. Tan cowhide $\frac{3}{32}$ in. thick is the best material. To make a case, first measure the camera and cut out the pieces. As the front, back and ends are all in one piece, you can get the measurement by wrapping a tape measure around the camera lengthwise, allowing $2\frac{1}{2}$ in. additional for a flap. Allow $\frac{3}{8}$ in. additional in width. Also allow $\frac{1}{8}$ in. additional length on the two side pieces. Next cut two pieces of cardboard to the shape of the side pieces and glue them to the flesh side of the leather. The cardboard reinforces the sides. Next, with a bluntly-pointed hardwood stick, impress a line around the leather pieces $\frac{3}{32}$ in. from the edges to serve as guide lines in laying out the holes for stitching. A few additional lines can be made for decoration if desired. Lay out the holes, spacing them $\frac{3}{16}$ in. apart and punch them with an awl. Note how this is done in the left-hand details. The holes are made vertically in the main part of the case and at a slant in the side pieces. To begin sewing, cut $1\frac{1}{4}$ yards of thread and use a needle at each end. First sew the left side piece to the main part, starting at hole No. 1 and pass both needles through each successive hole. When you finish, one needle will have to pass through the last hole twice so that the thread can be tied inside the case.

Donkey Guards Your Door

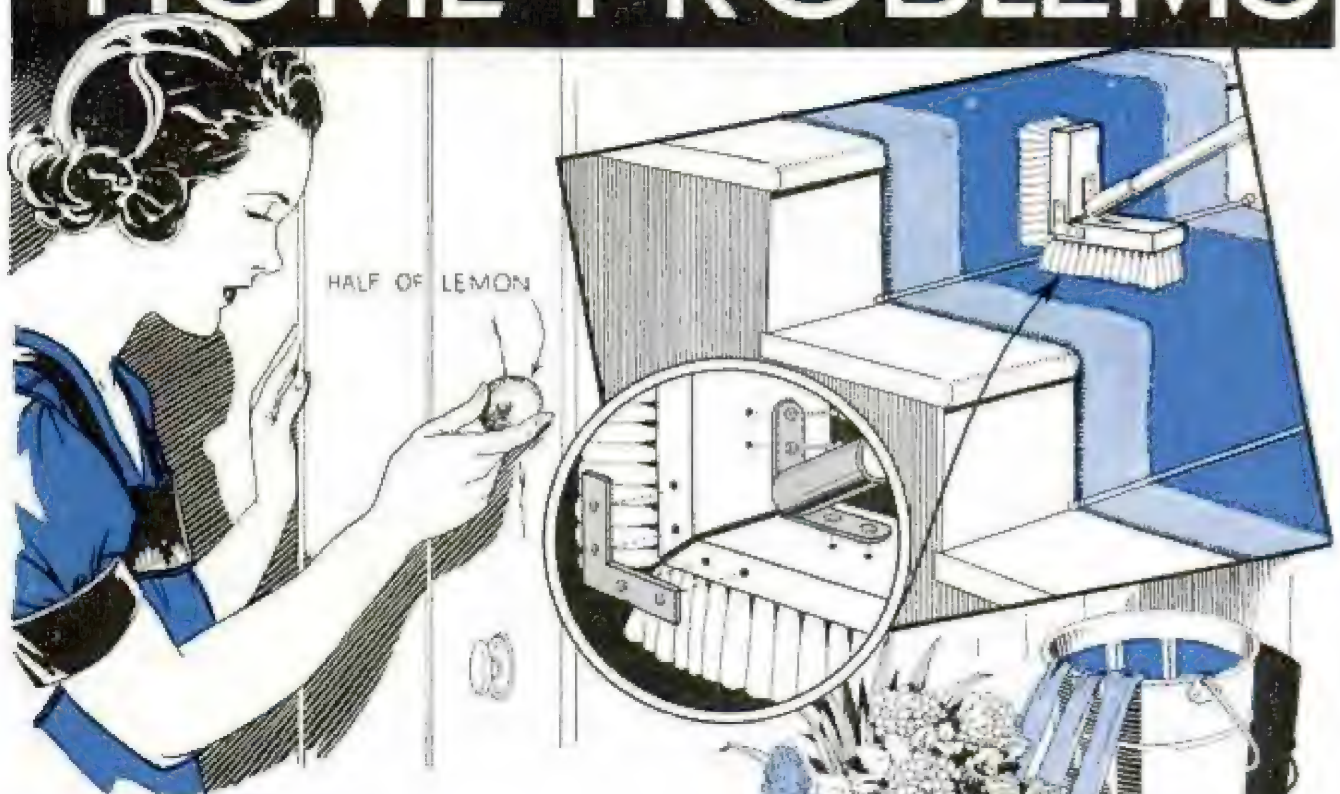
Here's a novel door stop that you can make in an hour or so. It is sawed out of $\frac{1}{4}$ -in. plywood and is painted black with the exception of the feet, nose and eyes, which are white. A couple of rubber-head tacks form the pupils for the eyes. A wedge-shaped piece to slip under the door to hold it is screwed to the rear side near the bottom as indicated in the detail. A piece of small wire coiled and inserted into a small hole drilled in the animal serves as a tail.

—Harold Boquist, Chicago.

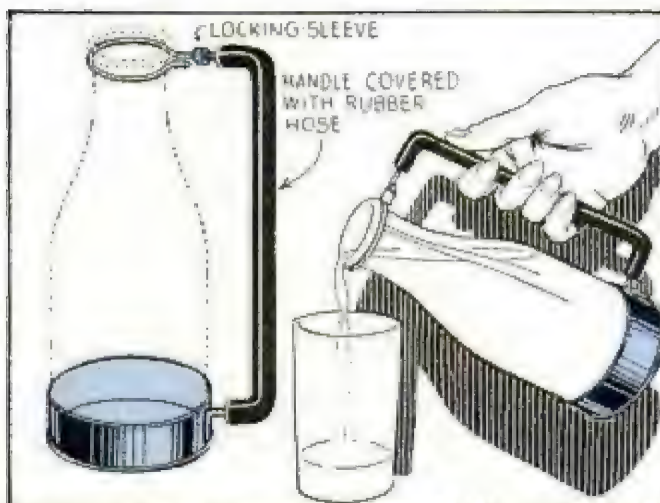


A wedge-shaped piece screwed to the rear side of the donkey slips under the door to hold it

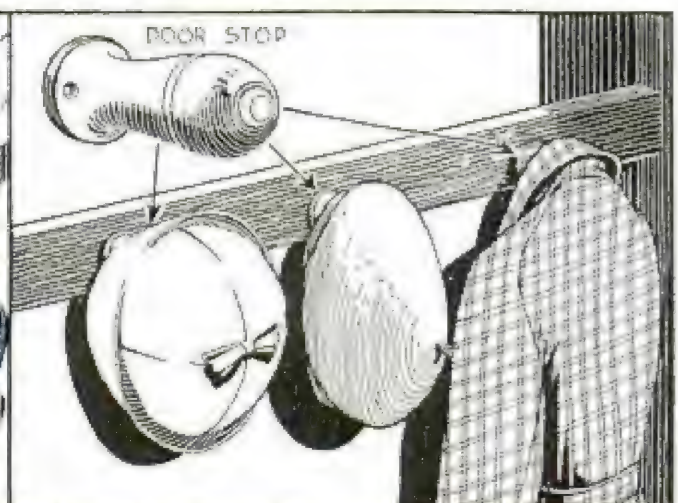
HOME PROBLEMS



Many marks on woodwork can be removed by rubbing with half of a lemon as shown above. When dry, rub the spot with a cloth and vaseline. Right, a brush to clean in corners of stair steps made by joining two floor brushes at right angles with angle brackets and providing them with a handle. Muslin strips leading from a bucket of water to your potted plants will keep them watered while on a vacation. Raise the bucket above the pots and weight the ends of the strips inside.

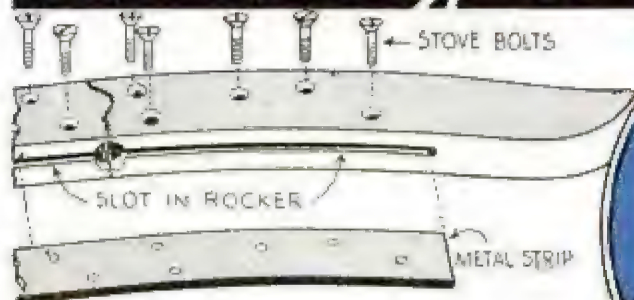


A length of medium heavy spring wire bent to the shape shown, with a shallow, metal cup soldered to the lower end, makes a dandy handle for milk bottles. A locking sleeve clamps the handle to the bottle neck.

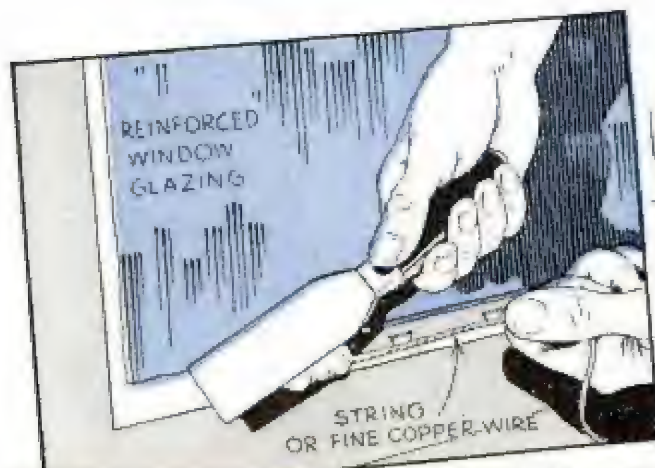


Wood doorstops screwed to the walls of a closet or on the back of a door make good clothes hooks. The rounded surfaces of the stops conform to the shape of the garments and help to keep them from slipping off.

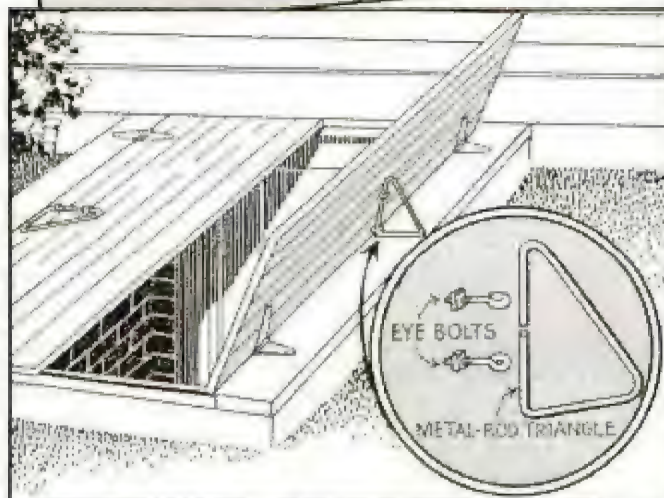
Easily Solved



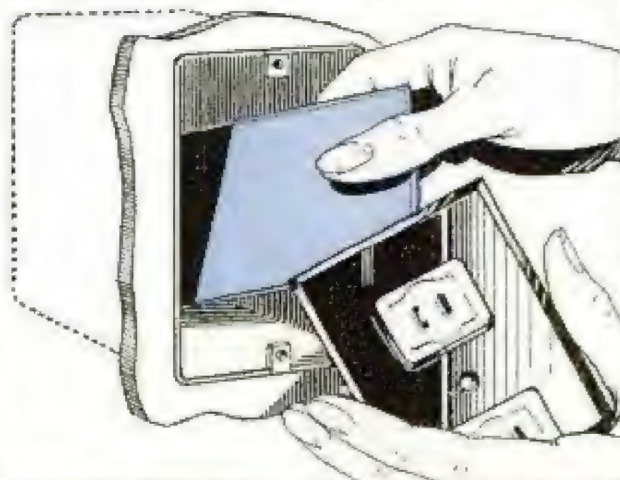
A strong splice for a broken chair rocker is made by slotting the rocker on both sides of the break and inserting a metal strip as above. The strip is fastened with bolts, which are countersunk and covered with wood putty colored to match the rocker. A cotton string or a length of fine copper wire imbedded in the putty of a window sash will prevent loss of broken pieces, which allow rain to release the remaining parts



Slots cut in a coal shovel with a cold chisel will make it possible to sift ashes right in the ash pit and return the unburned fuel to the firebox immediately. This not only saves fuel but materially reduces the ash-carrying chore



These props automatically swing into position when you open your outside cellar doors. Made from $\frac{1}{4}$ -in. iron rod, the props are hinged with eyebolts and rest in grooves flush with the door surfaces



A dummy wall electrical outlet installed in the regular way, but without wires, provides an unsuspected hiding place for small articles of value. Removal of as much inside mechanism as possible will give more storage space



Typist's Adjustable Copy Holder from Old Desk Lamp

A typist's copy holder that is adjustable to any position is made easily from an old flexible-shaft type desk lamp. The shade, lamp and socket are removed, and the end of the shaft is plugged with wood so that a piece of sheet metal can be screwed to it as indicated. The sheet metal is bent at right angles at the lower end to support the copy, while two spring-type clothespins hold the copy at the top end.

—Harry Lampert, Sierra Madre, Calif.

Ⓒ Damp cupboards or closets can often be kept dry and sweet by placing a small pan of lime in them. In most cases, it will not be necessary to renew the lime more than once every two weeks, and never, until the lime becomes slaked.

A Masterpiece in Ship Models

Do you want a model of one of the most outstanding warships in history? If so, build the "Sovereign of the Seas." Complete information on the construction of this ornately decorated, and highly picturesque model, 34 in. long and 26 in. high over all, is given in our blueprints 828 to 835 incl., priced at \$1.50 per set. Descriptive text in bound book, \$1.00 additional.



OTHER WORTH-WHILE MODELS

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Prairie Schooner—728: Model is quaint reminder of covered-wagon days. Wagon without top, 8 3/4 in. long—25c.

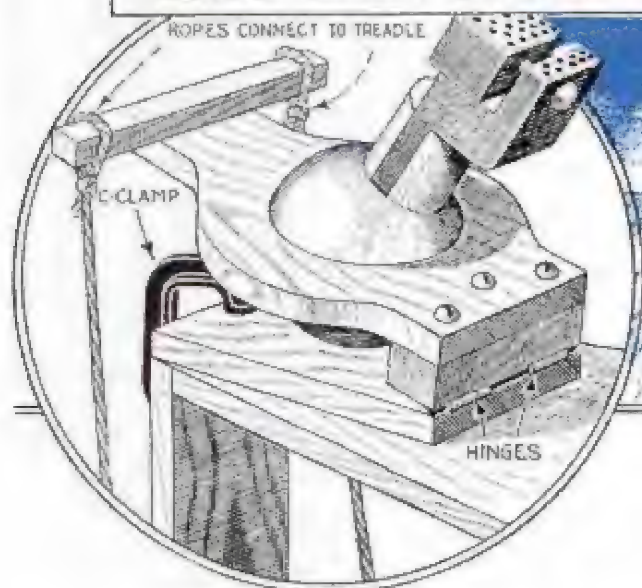
Model Colonial Cannon—735: Perfect 10-in. miniature of guns used during days of 1776. Turned brass and wood—25c.

Blueprint Department, Popular Mechanics Magazine, 200 E. Ontario St., Chicago



Model-Makers' VISE

has universal action

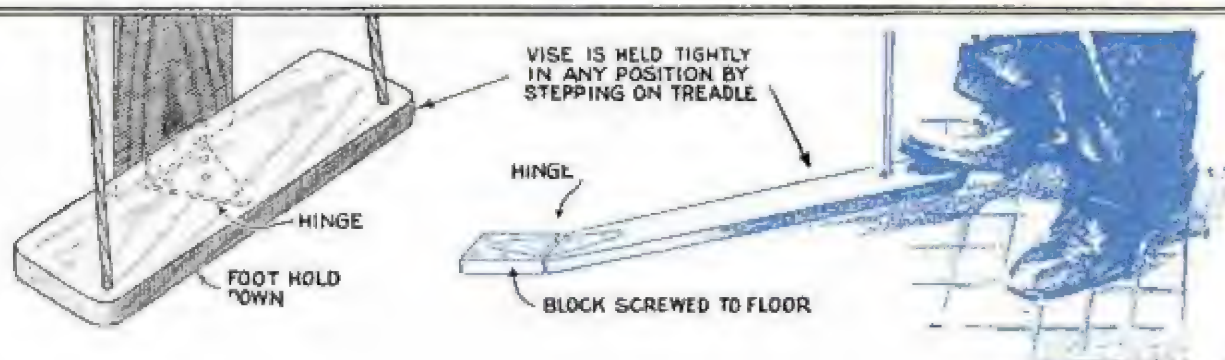


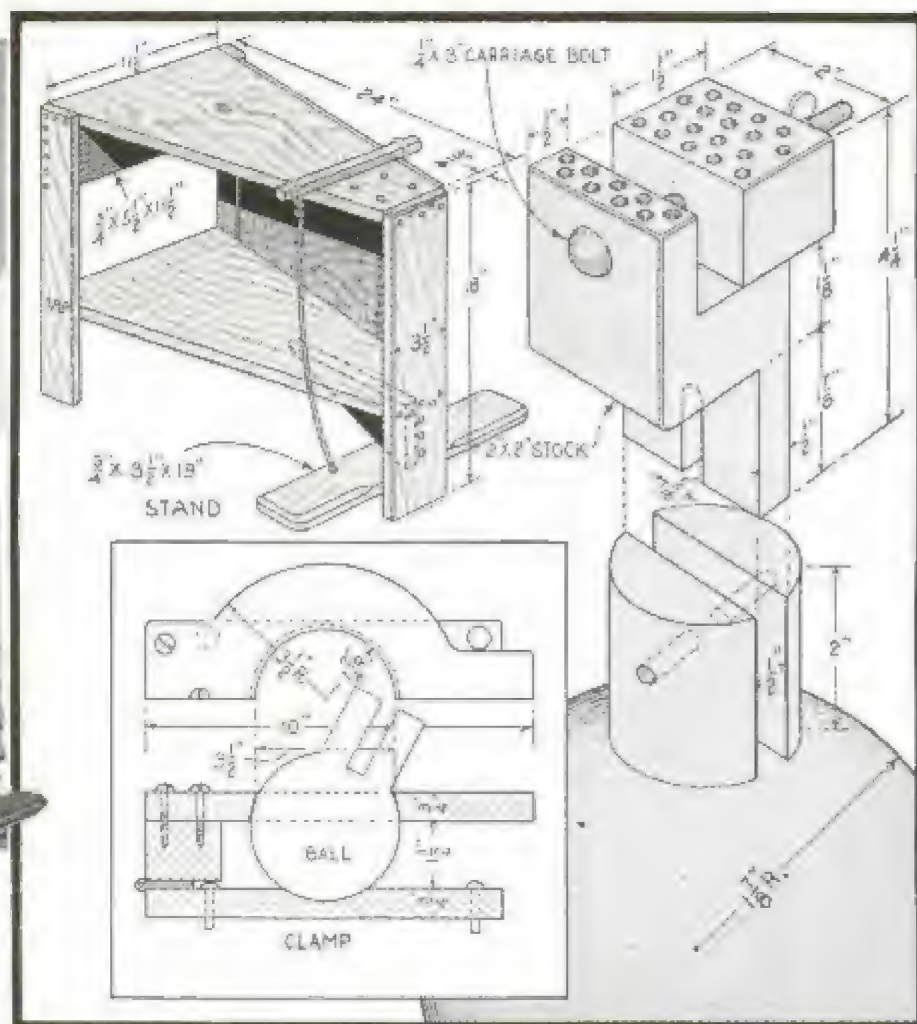
By
EDWIN M. LOVE

QUICK ACTION—that's the thing you want in a vise for holding small parts. This one is operated with your foot. A ball-and-socket mounting allows the work to be tilted in any direction or rotated to either side to hold the work handy to the operator when working on small parts for models that require carving, grinding, filing, or painting.

To use the vise at a bench, clamp the un-

der piece to the bench top and loop a cord over the free end, adjusting the length so that one foot can be set in the loop at the lower end and rested on the floor. Since small work can best be handled while the operator is seated, another plan is to make the three-cornered stand shown in the drawings. A seat and a shelf board cut from 1 by 12-in. lumber, are joined to legs cut from 1 by 4-in. stock. Braces as shown





and a piece of plywood nailed across one side give sufficient rigidity.

Turn the ball from hardwood and slot the neck to receive the vise, putting a carriage bolt through at this point to grip the vise shank. The clamp-ring circle is cut out at an angle so that it will rest on the ball with the underside about on the diameter. If it is made much smaller, heavy foot pressure will be required to hold the ball rigidly. On the other hand, don't get it too large, or it will slip over the ball. Screw a block under the broad end for hinging to the base piece, which is 1 by 4-in. stock, hollowed a little to receive the ball. Use a heavy hinge, having little play in the joints. Make the vise proper from a single block of 2 by 2-in. hardwood. The loose jaw is sawed from the block and a hole is bored through both jaws for the clamp bolt, which is drawn tight while the jaws are dressed even. Slot the shank to straddle the bolt in the ball neck. As a convenience for clamping flat, thin work, bore a number of small holes in the tops of the jaws, the holes a little larger than

8-penny finishing nails, and cut several 8-penny nails to $\frac{1}{2}$ -in. lengths to use as pegs. This is an arrangement borrowed from engraver's vises, and is especially handy for holding small, flat work.

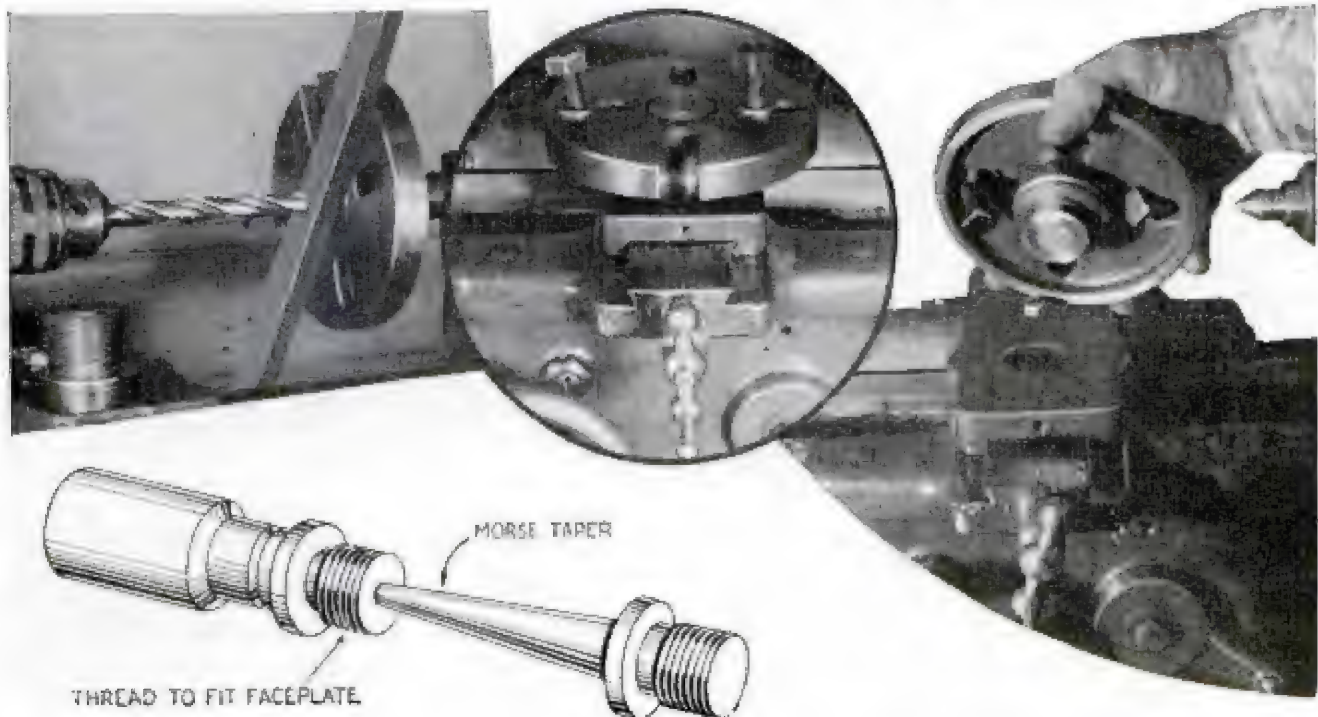
Shotgun Shells Carried on Glove for Quick Reloading

It's no trick at all to sew a strip of thin leather to the back of your heavy winter gloves to form loops for two shells or cartridges. For quick reloading of a gun, it works nicely, and no cripples get away while you are fumbling in a pocket for shells with numb fingers. The



extra weight of the shells is insignificant and, after wearing the glove on a hunting trip or two, you'll find it a great convenience.—J. M. Robinson, New York City.

Lathe Faceplate Used in Drilling and Milling



Using your own lathe for the work, you can make the faceplate serve as a handy milling table or as a drill pad by simply turning out two threaded adapters. One of these is turned with a Morse taper to fit the tailstock quill, the other is shouldered and flanged to fit the compound slide. Both adapters are turned out of a single piece of cold-rolled steel, the various diameters de-

pending wholly on the size and type of the lathe and the number of the Morse taper. Usually the adapter which mounts the faceplate on the compound slide requires a small tapered section just beneath the flange. Care is necessary in cutting the threads but once you have the setting, both sets can be cut without shifting the work.

—Burl Knutson, Bismarck, N. Dak.

Magazines Clipped to Wire "Skirt" on Newsstand Counter

Stapled to the front side of the counter at a newsstand, a length of heavy, woven-wire fencing provides a handy place for displaying magazines. The latter are suspended with clips from the fencing, the cross wires permitting neat arrangement.

Electric Winker Serves as Photo Second Counter in Darkroom

When printing photos, the exposure time can be measured by means of a light flasher instead of a darkroom clock. A cheap flasher obtainable at almost any dime store will do. In use, it is fitted with a red lamp and set in a convenient position near the printer. You just count the number of flashes required for correct exposure of a print instead of figuring the time by seconds.—K. F. Keith, St. Petersburg, Fla.



Woven fencing wire stretched taut at newsstand provides handy place to display magazines

Castered Hand Rest for Welder Saves Arm Strain



This support for welding torch allows it to be manipulated without undue strain on the arm

A welder in one shop who has considerable work to do on flat surfaces uses the castered support shown on which to rest the torch, thus reducing the continuous strain on the muscles of his arm. The support consists of a short length of steel tubing, which has a caster fitted in the lower end. In use, the support is held between the fingers of the hand that also holds the welding torch. The caster allows the torch to be moved around as desired as it rests on the surface of the work.

Cores for Metal-Casting Jobs Made with Grease Gun

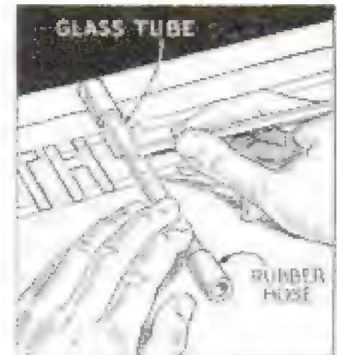


On a casting job that required a number of $\frac{1}{2}$ and $\frac{3}{8}$ -in. cores, time was saved by making them with a regular auto grease gun of the type in which the plunger is screwed into the gun. Nozzles of the required inside diameter were turned on a lathe and

attached to the gun, after which the wet core mixture was forced out through the nozzles by screwing in the plunger.

Glass Ruler Aids Sign Writer in Laying Out Letters

For laying out vertical letters on a card or sign, without the use of the T-square, one artist designed the rolling glass ruler shown. It consists of a glass water gauge, about $\frac{1}{2}$ in. in diameter, which is fitted with a short section of rubber hose at each end. The hose pieces allow the ruler to roll across the card in a vertical line, without slipping, and the glass permits the operator to space his lettering accurately.



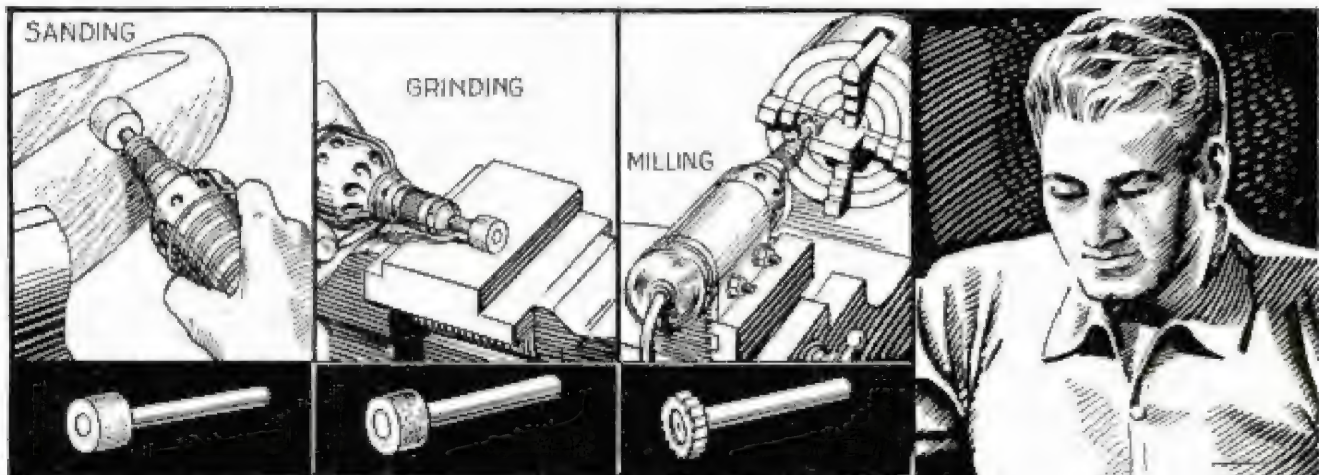
Tray Has Handle on Bottom to Prevent Slipping

A waiter in one restaurant who often carries his serving tray on his upraised hand, has a strap riveted to the bottom to take his hand so that the tray cannot slip off. The loop in the strap should fit snugly over the hand.



Hand loop on bottom of serving tray enables waiter to carry it without danger of slipping

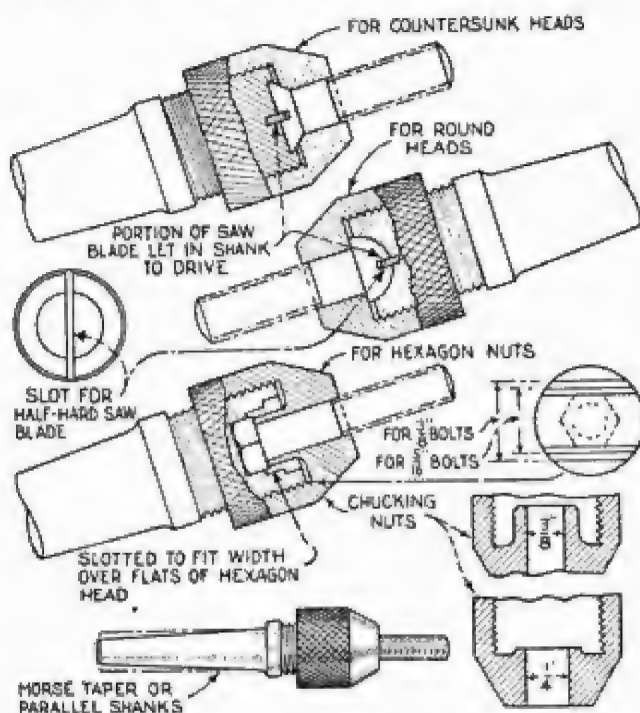
Small Hand Grinders Do Many Intricate Jobs



You'll find many uses for small, high-speed hand grinders in your shop, especially on small work that requires rather delicate operations. One may be mounted on a lathe compound rest for accurate grinding, milling, dividing, etc. A block is cut to fit snugly the T-slot and hold the grinder on center. A screw bolt through the center of the block keeps it from moving, while a wide strip of sheet metal bent over the grinder and screwed to the block holds it steady. Numerous attachments are available for the grinders, and you can quickly make any of unusual shapes that may be needed. Cutters can often be

turned from wood and coated with glue and emery, while sanding drums can be made from corks covered with abrasive paper.—J. S. Wilcox, Los Angeles, Calif.

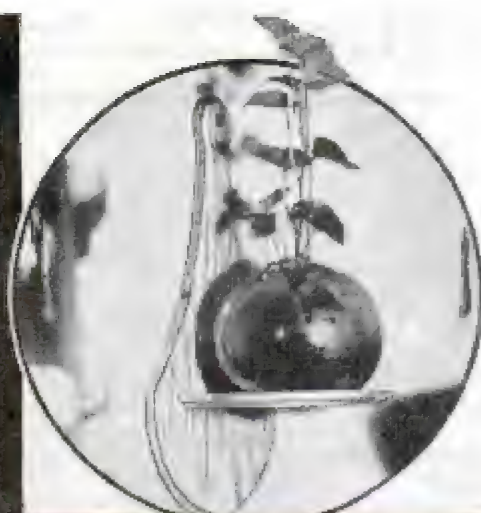
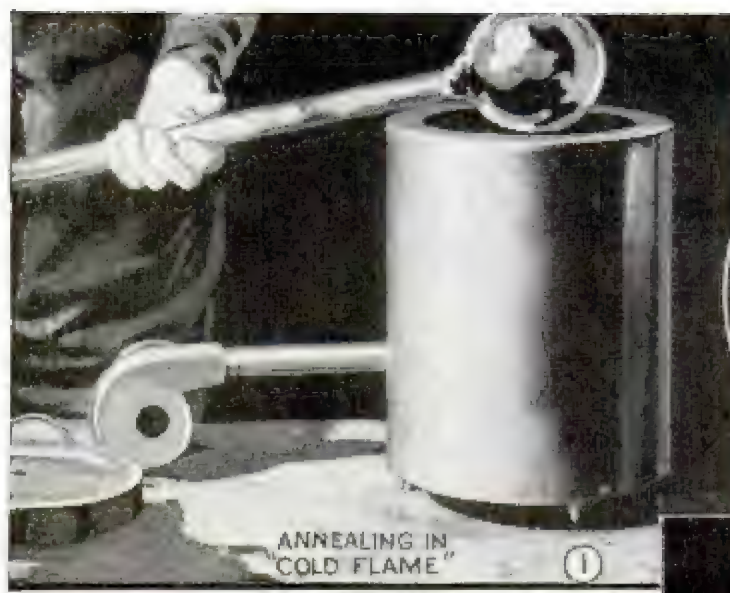
Lathe Chucks to Hold Small Parts Save Operator's Time



These little chucks will save time in the shop in machining bolts, screws and similar work

Useful in the home workshop, garage and similar places, these small chucks are easily turned from cold-rolled stock. They are especially useful for holding screws and bolts, which must be machined slightly. As shown in the detail, each chuck consists of a shank tapered to fit the lathe headstock and a screw cap. The three types shown are for holding hexagon-head bolts and flat and round-head screws. The upper ends of the shanks for holding bolts are step slotted to take bolt heads of three sizes, while the two for holding screws are recessed to take the heads and are provided with small pieces of hard steel to fit into the screw slots to keep them from turning. Note in the lower detail that the inside surface at the top of each screw cap is shaped to bear firmly against the underside of the screw or bolt head.

—F. Doughty, Shipley, Yorks, England.

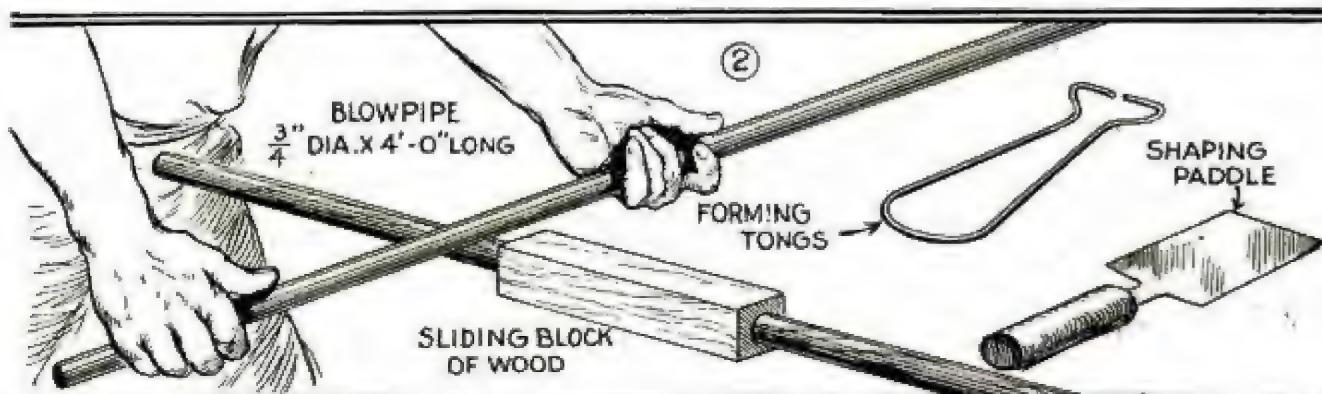


GLASS

FUNDAMENTALLY, glass blowing is like blowing soap bubbles. You gather a bit of the liquid on the end of a pipe and blow it up to shape. In experimenting with some of the simple phases of this interesting handicraft, the chief requisites are a furnace capable of producing a sustained inside temperature of 2,000 to 2,200 deg. F. and a crucible. The blast furnace shown in the accompanying photos is small, well insulated and has a high-speed motor to provide a steady air blast. Gas from a water-heater connection is fed into the mixing chamber ahead of the blower by means of a rubber tube. Regulation of air and gas mixture can be varied by opening or closing the gas valve. Removal of the vent nipple is necessary as the furnace uses more gas than a water heater.

Heat the crucible slowly over the flame, then set it inside the furnace and adjust the gas to give a noisy, blue flame. Break up a couple of bottles as shown in Fig. 3. Cheap glassware is another ideal source of supply. It's important to use bottles of the same kind and color for each batch. It is

inadvisable to go to the original source of glass—sand—and work from there, because it involves detailed precision and invites trouble in removing the sludge and adding ingredients. Place small pieces of glass into the crucible with a pair of tongs. As the glass melts down, add more small pieces. Large pieces often crack and fly about and since molten glass will “wet” nearly anything with which it comes in contact, care must be taken to keep it from the sides and bottom of the furnace. Many bubbles will occur in the glass as it softens. They rise slowly to the surface and may be skimmed off, broken with a wire, or allowed to break under sufficient heat. Remove the furnace lid occasionally and examine the contents. When the molten glass is about the consistency of molasses at room temperature it is ready to work. For simple blowings as illustrated here a malleable iron pipe about $\frac{3}{4}$ in. inside dia. and 4 or 4½ ft. long, Fig. 2, will serve as a blow



X 310



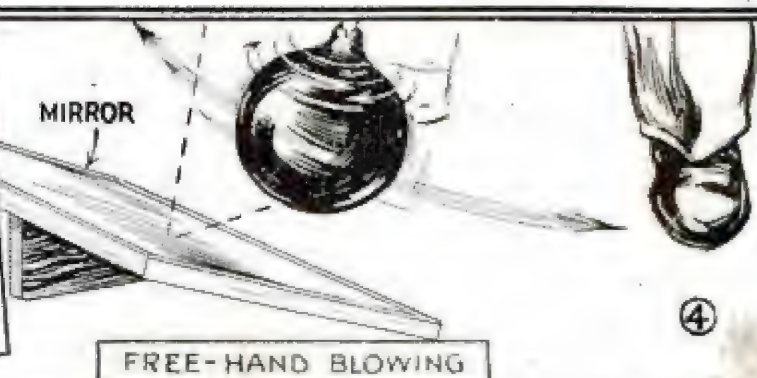
BLOWING

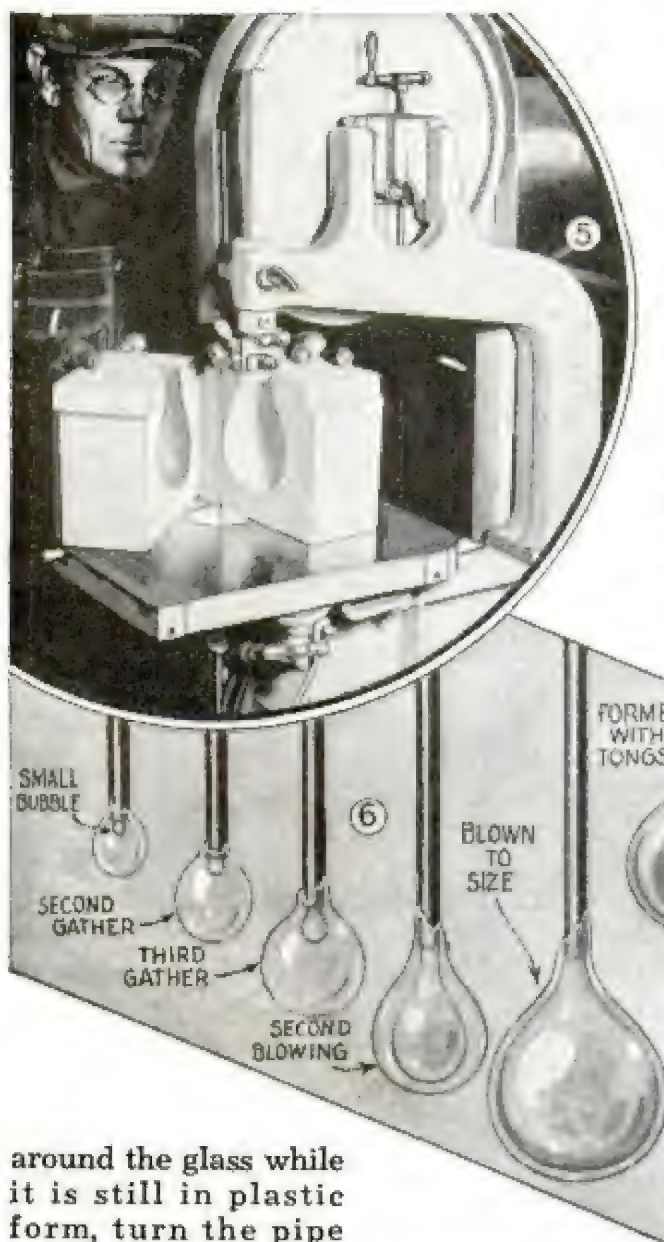
pipe. Heat the blow pipe end until it is cherry red. Dip this end into the glass, turning it slowly until a crude ball has formed on the end. Lift from the crucible and hang the pipe downward, swinging it slowly back and forth. With controlled breath, force a small bubble into the glass. Then, return the pipe to the crucible for another gather, adding a second layer. See Fig. 6. If too much time elapses before the glass thread can be broken, have a helper snip this off with a pair of shears. The number of gathers you make determines to a large extent, the size to which you can safely blow the glass. The softness of the glass is also a determining factor. Experience is the best teacher as to the exact procedure to follow.

A marver, Fig. 10, which is nothing more than a shallow wood trough with sloping sides on which the plastic wad of glass is rolled back and forth, will prove

helpful in the shaping operations. To flatten the bottom, the glass is tapped on the underside. When

the last gather has been made, begin to blow steadily with the pipe hanging vertically from your lips. A mirror set on the floor at an angle, Fig. 4, will help you to ascertain if the bubble is centered in the ball. As the glass cools, you must apply more pressure, continuing to turn the pipe. Angling the pipe, too, will help to keep the piece symmetrical. If the ball stretches into an oblong affair, you can return it to shape by inverting the pipe so the glass is on top, and letting it settle. Continue to rotate the pipe until the glass is no longer plastic. If the shape is unsatisfactory, reheat the stuff in the open flame of the furnace and work your lungs some more. To provide a long neck that can be nicked with a file, then broken off, a pair of forming tongs, Fig. 2, should be employed. The tongs can be shaped from any small iron rod and should have a jaw opening about the size of the blow pipe. Fit the tongs



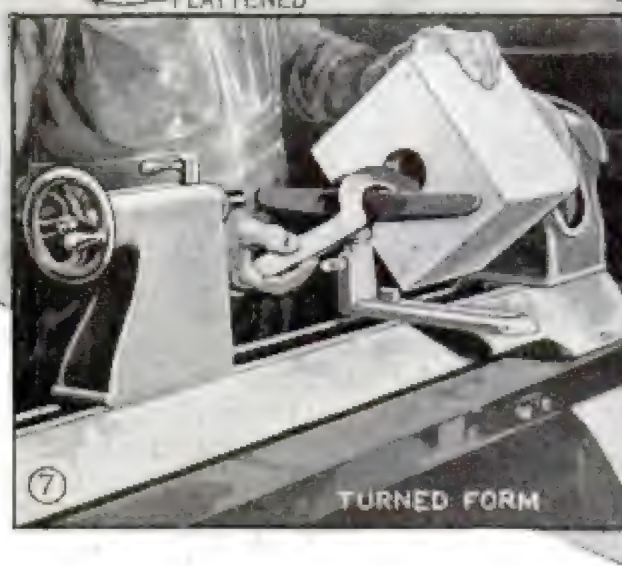


around the glass while it is still in plastic form, turn the pipe slowly and at the same time pull upward to stretch the neck to the desired length. When hard, let a few drops of water fall on the glass near the top of the neck, as indicated in Fig. 12, and it will break from the pipe. Allow the piece to fall on a wad of cloth, wrap it in other cloth, Fig. 8, and stow away in a furnace ash pit or other suitable place to cool slowly. When cold, the sharp edges can be ground down. If you desire to experiment with annealing, which tempers the glass and increases luster and brilliance, leave the piece on the blow pipe and rotate it in a cold frame, Fig. 1, (flame of the furnace with the air blast shut off). This takes 30 min. or longer depending upon the size. When finished crack it off with a file or hot wire, and wrap it in rags to cool.

For a glass vessel with a large mouth the procedure is somewhat different. You

blow the piece to shape, keeping in mind that the top will be well down below the end of the blow pipe and attach a sticking-up pin or pontil as shown in Fig. 17. This is a round iron rod heated to cherry red. A small amount of glass is gathered on the hot end, stuck to the bottom of the flattened article and allowed to harden. Then, the glass is broken off the blow pipe as suggested in a preceding paragraph. Now you have control of the piece at the bottom instead of the top. Rotating this in the hot flame of the furnace to soften the edges will enable you to trim off the waste with a pair of shears or tin snips. It will cut about like shoe leather. Final shaping can be done with another hot iron or charred wood stick. When the piece is finished you

touch the bit of glass holding the sticking-up pin with a drop of water and it will break



loose. The rough spot is later ground smooth. To add a pouring spout, heat the rim of the glass until it is slightly plastic, and shape it with a hot iron or pontil, Fig. 13. Adding a handle is not much more difficult. First, dip a hot iron in molten glass and make a gather. Cut it loose from the crucible quickly. As the string of glass drops into a thick cord, hold it close to the floor and clip off a piece of suitable length and diameter, Fig. 14. Quickly flatten the ends of this rod with pincers or paddle, as illustrated in Fig. 15, and curve it to ap-

proximate shape, Fig. 16. Have one end of the handle and that portion of the vessel to which it is to be attached, hot enough to be "tacky" and stick them together. With charcoal stick and blow pipe, work the fused spot smooth, then place the lower end of the handle in position, Fig. 18, fuse and smooth again.

A form for blowing pieces to a definite shape can be made from a number of square hardwood blocks about 1 in. thick. Fasten a block to the face plate of a wood turning lathe. Nail another to it, the nails being driven into the corners. Make a template which is half the circle or shape of the desired glass article, Fig. 7, from thin material. Continue turning and nailing on additional blocks until the form is complete, including the neck. Saw this squarely in two as shown in Fig. 5. With a blow torch, char the inside of each half. To complete the forms, fit the blocks with guide strips so you can slam the pieces together instantly.

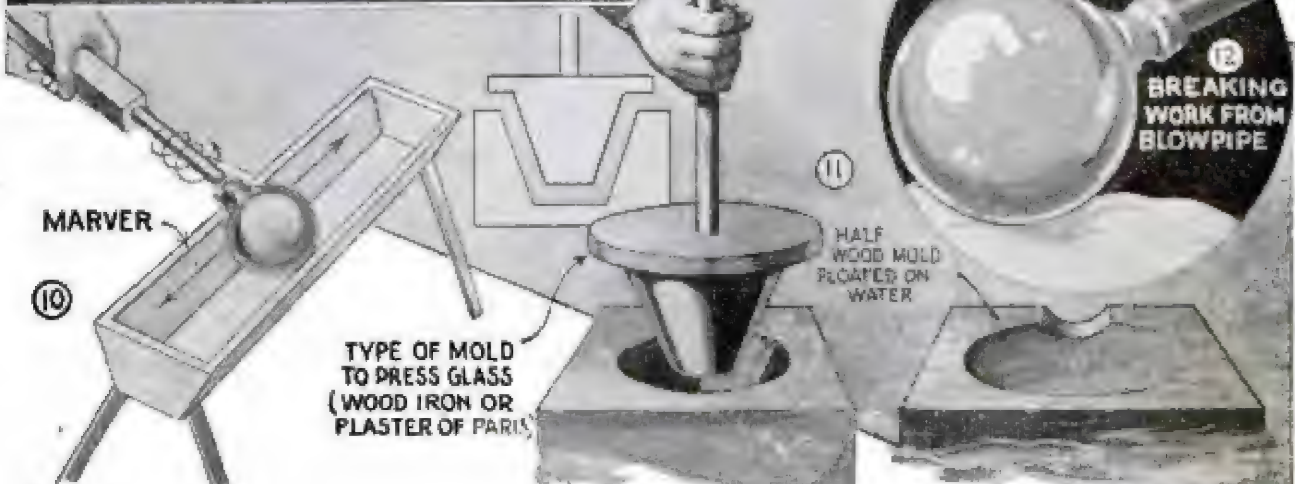
Preparation of the glass for this method is identical with free hand blowing. Form the gather in the same way, and place the

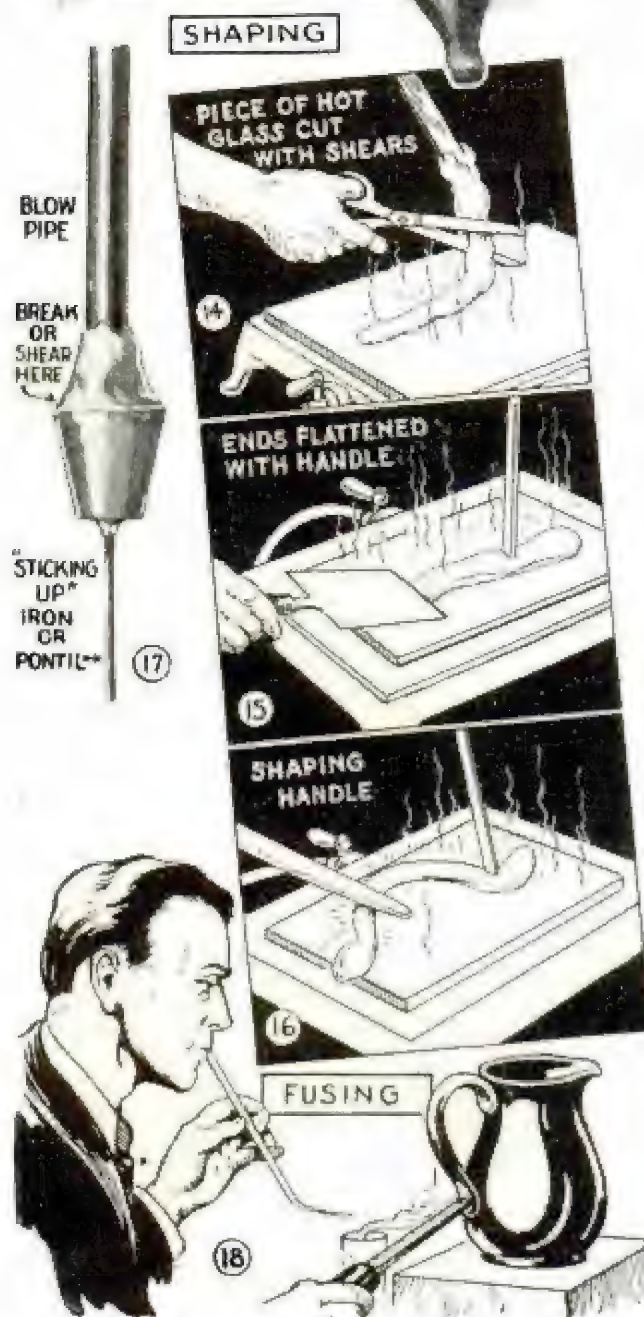


ball of glass inside one half and fit the pipe in the neck. Then push the forms together and have an assistant hold them while the glass is being ballooned out against the sides. Turn the pipe slowly so that any irregularities of the form will not show on the glass. When finished, pull the forms apart, Fig. 9, anneal the glass and remove it from the blow pipe with a drop or two of water, as previously described.

A phase of glass blowing involving but half a form is shown in Fig. 11. The cavity in the half form represents the shape of the finished article. The form is wet down with water or actually floated on water. A glass ball is blown to approximate shape, then inserted in the half form. Steam accumulates instantly but the glass is too hot to crack so it provides a cushion between form and glass. The pipe is rotated as much as possible and after a reheating or two, the article takes the shape of the form.

Other interesting experiments with molten glass consist of making a bubble





lens for a night light, and a magnifying glass. The light lens is made by melting a small quantity of glass, preferably red or green tinted, and stirring in a bit of sodium bicarbonate. The resulting mass is poured into a circular, flat-bottom mold. Some effervescence is caused by the soda, and the glass plate, flat on one side and full of bubbles of varying sizes on the other provides a novel effect when fitted into a small wooden box having vents in the top, a lamp socket fastened to the bottom and the bubble glass set in a round hole on one side. To obtain a magnifying glass that is true enough to set fire to wood or cause water in a spoon to boil in a few seconds, turn a form 5 or 6 in. in dia. from hardwood and pour it full of clear glass. Both the flat and curved sides must be worked down and polished.

In glass blowing, perhaps more so than in most other hobbies, the results that may be obtained depend almost entirely on the experience and skill of the craftsman. You can have a lot of fun even though you are unable to duplicate the work turned out by skilled artisans.

Do You Weigh Your Ashes?

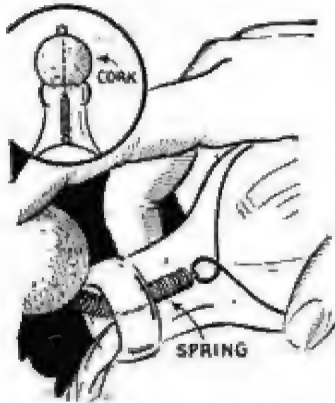
Have you ever weighed the ashes that drop through the grates of your furnace? Firemen in factories are often told to weigh the coal burned and to keep a strict account of all water used in the boilers to determine the quality of coal. A simpler method is to weigh the ashes. It is the ash content that usually determines the calorific value of coal. Coal from the same mine may show a widely differing ash content and therefore it is logical to keep tab on the refuse, which costs just as much per pound as the good combustible matter. Try different coals of the size suitable for your furnace and grates and the one with the least ash content which sells at a low price should show pretty good results. Later this can be double-checked by noting how well the coal evaporates the water.

—W. F. Schaphorst, Newark, N. J.

(Notations on a negative that must be observed in the darkroom should be made with a blue pencil, as this shows up better than ink or pencil marks.

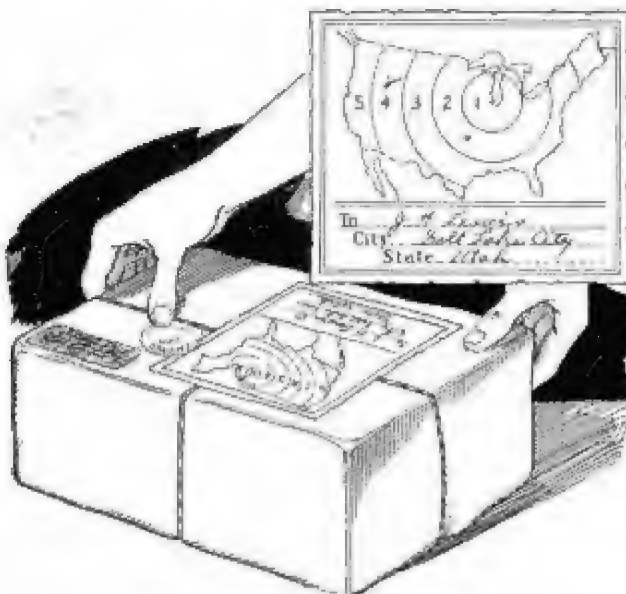
Bottle to Hold Volatile Fluids

A foreman of a print shop, noting the frequent neglect of employees to replace the stopper in a bottle of inflammable cleaning fluid, devised the self-closing stopper shown. It consists of a cork ball, attached to a stout coil spring with a cross bar of spring wire at the opposite end. When assembled and inserted in the bottle as indicated, the ball seals the opening, but may be rolled to one side to pour the contents.



Map of Mailing Zones on Sticker Saves Time in Mailing Room

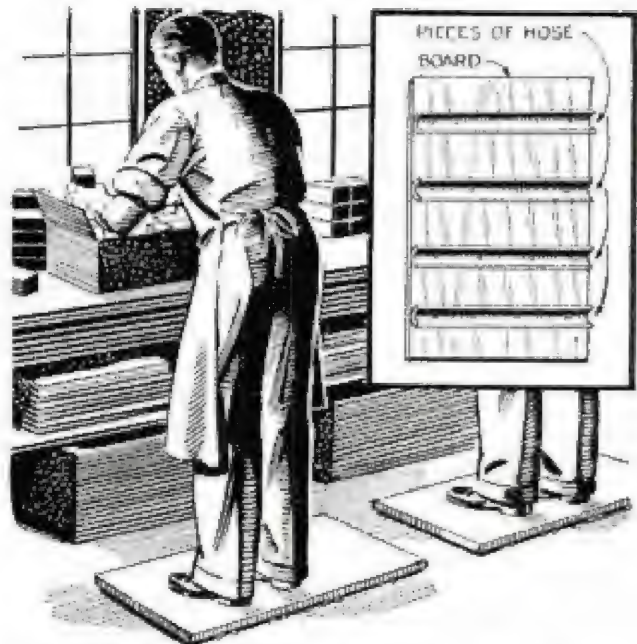
Clerks in large mailing rooms of offices and factories can save considerable time if the address stickers have a map of the mailing zones printed right on them. With such stickers, the person writing the address can immediately determine the zone



Mailing-zone maps on address stickers show at a glance the zone at which the addressee is located

in which the addressee is located and indicate it by a check on the map. This will save time for the clerks in the mailing room as all they have to do is to glance at the map to get the correct zone.

Dry Platform for Workmen on Wet Floors

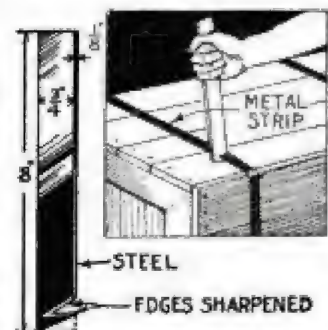


Workmen's feet kept off of wet floors by platforms supported on pieces of split hose

To protect the feet of his workmen against damp floors the foreman of a western canning factory provided each of them with a platform on which to stand. This consisted of a length of a wide board to the underside of which were nailed pieces of large garden hose split in two. The platforms were also more restful than hard concrete floor as the hose pieces made them slightly resilient.

Cutter to Sever Metal Binding on Large Boxes

Workmen in stores and warehouses who often have to open boxes that are bound with strips of thin sheet metal will find this tool handy for cutting the binding. Consisting of an 8-in. length of $\frac{1}{8}$ -in. flat steel, the tool is ground off at an angle at one end, after which a narrow slot is made near the same end, as indicated. The edges of the slot are sharpened so that when the tool is slipped over the bands, the metal is cut by pushing the upper end of the tool to one side.



Shipping Tags Held in Clothespins Are Filed Easily

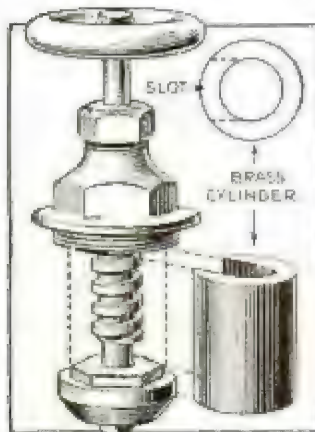


This shipping clerk keeps his tags in neat order by slipping them between legs of inverted clothespins

To keep his tags filed alphabetically and neatly at hand, a shipping clerk made a holder from a wood block and a number of clothespins. The latter are inserted head first into holes drilled in the block. The tags are filed by merely inserting them between the legs of the inverted clothespins, the natural springiness of the legs allowing several tags to be filed in each pin.

—Opie Read, Jr., Chicago.

Brass Sleeve Aids in Grinding Steam Valves



In railroad shops and other places where it is necessary to grind steam valves frequently, this sleeve will be found a time saver. Instead of removing the valve from the stem by unscrewing the nut and applying a washer between

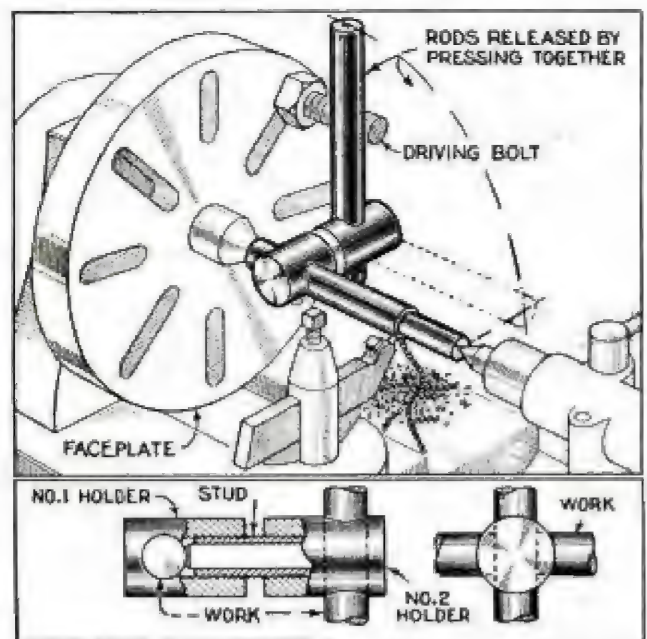
the disk and the end of the valve stem as is often done when grinding, use this sleeve which makes it unnecessary to remove the disk. Merely slip the sleeve on

the stem from one side between the valve and the bonnet, after which a slight pressure exerted upon the grip will clamp the disk sufficiently tight to allow for grinding.

—O. S. Sprout, Lancaster, Pa.

Lathe Dog Holds Two Pieces

On a job of turning down a number of small, short rods this wrenchless lathe dog was found to save considerable time, as it held two rods, one rod being used as a dog to turn the other one. To make the dog, two short pieces of 1-in. cold rolled steel were drilled through the side to take the work, and then drilled and tapped at one end into these holes to take a stud, which was drilled to take a distance pin. This pin was rounded at both ends, hardened, and made just the right length so that when assembled with the two pieces of work in place, they were tightened up at right angles. In this position, each piece of work



This lathe dog holds two pieces of work, which alternately act as a driver for the one being machined

acts as a driver for the other alternately, and after machining, the rods are brought into line and released, two more slid in and tightened as before, making the use of a wrench unnecessary.

—H. Moore, Hamilton, Ont.

¶ When putting away paint for future use, pour a thin coat of paraffin on the paint to prevent the formation of a skin. The hardened wax is easily removed.

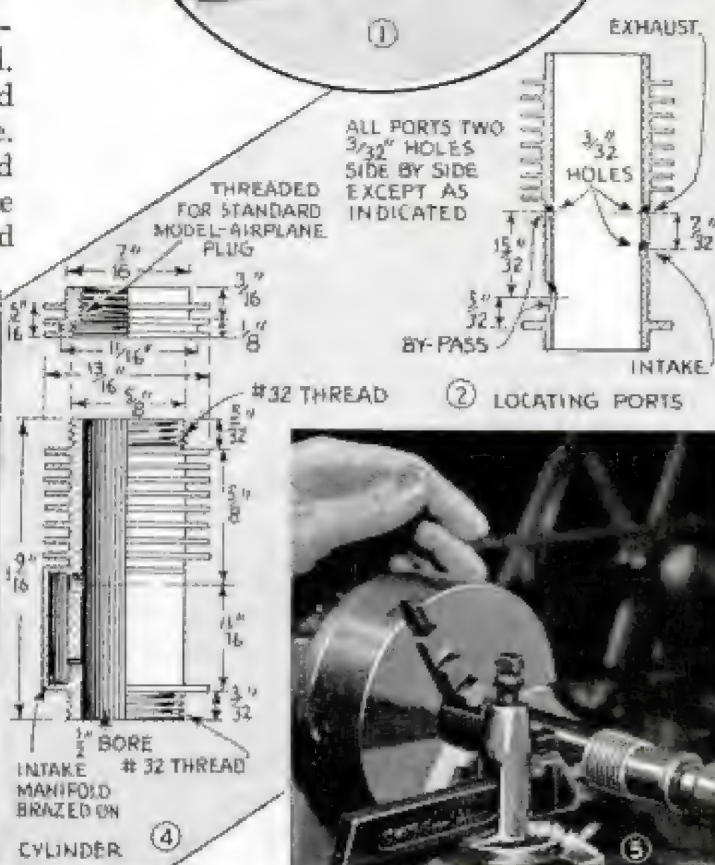
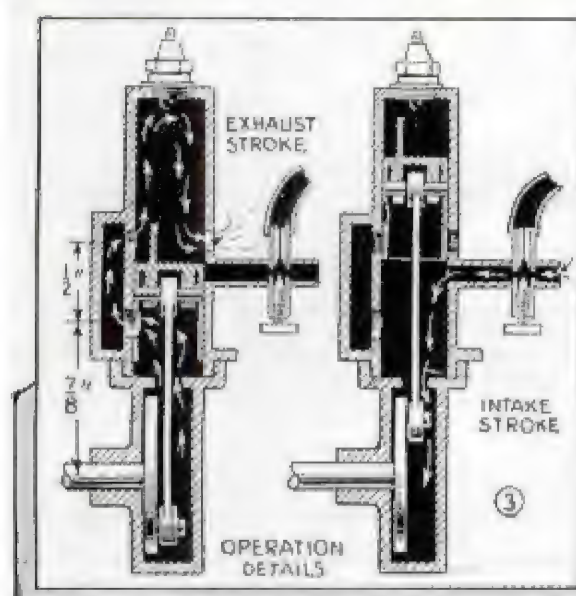
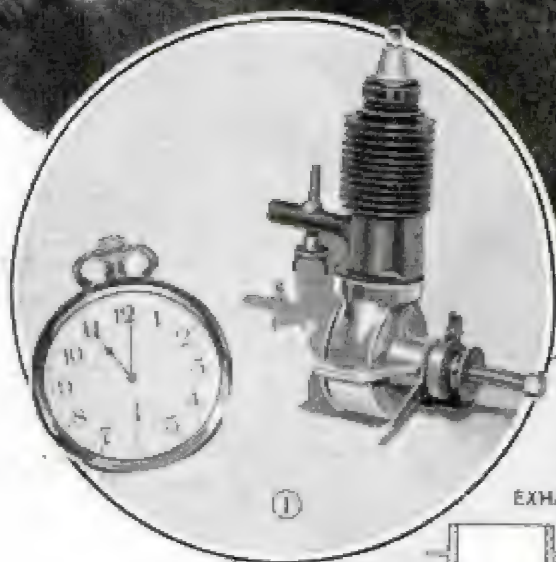
Midgyet **GAS ENGINE**
weighs only four ounces

Two-cycle operation reduces moving parts to the minimum, making it an easy lathe job

Two-cycle operation reduces moving parts to the minimum, making it an easy lathe job

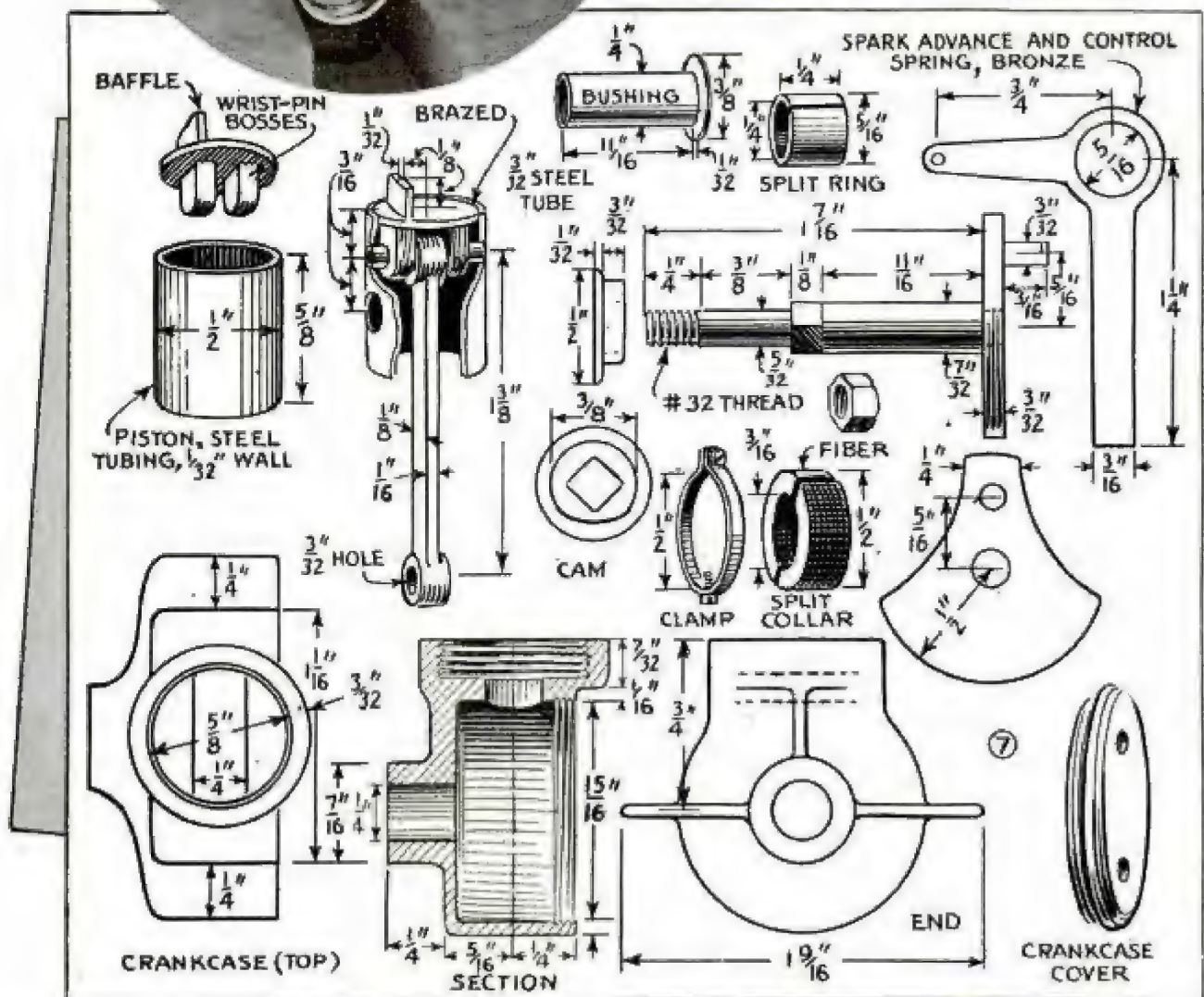
HERE'S one of the smallest practical gas engines ever built— $\frac{1}{2}$ -in. bore and a $\frac{5}{8}$ -in. stroke. Designed by three well-known model builders, Victor Savage, Erwin Schwartz and R. H. Barney, it has successfully flown a tiny monoplane whose total weight was only 17 oz., including the engine.

The cylinder is made from steel tubing $\frac{7}{8}$ in. in diameter with a $\frac{3}{16}$ -in. wall. This leaves a $\frac{1}{2}$ -in. bore, which should be reamed after chucking in the lathe. The first lathe operation is turning and threading the lower end which is to be screwed into the crankcase. Finished





to turn and thread the top where the head is to be screwed on and fifth, cut the cylinder to length with the parting tool. Before drilling the ports study the operation diagram, Fig. 3, which shows how the piston clears the ports in one position and closes them in another. Dimensions for locating port centers are given in Fig. 2. When these are drilled, as in Fig. 13, the cold-rolled sheet-steel manifold is brazed on the cylinder over the by-pass ports. See Fig. 12. At this stage the cylinder should be



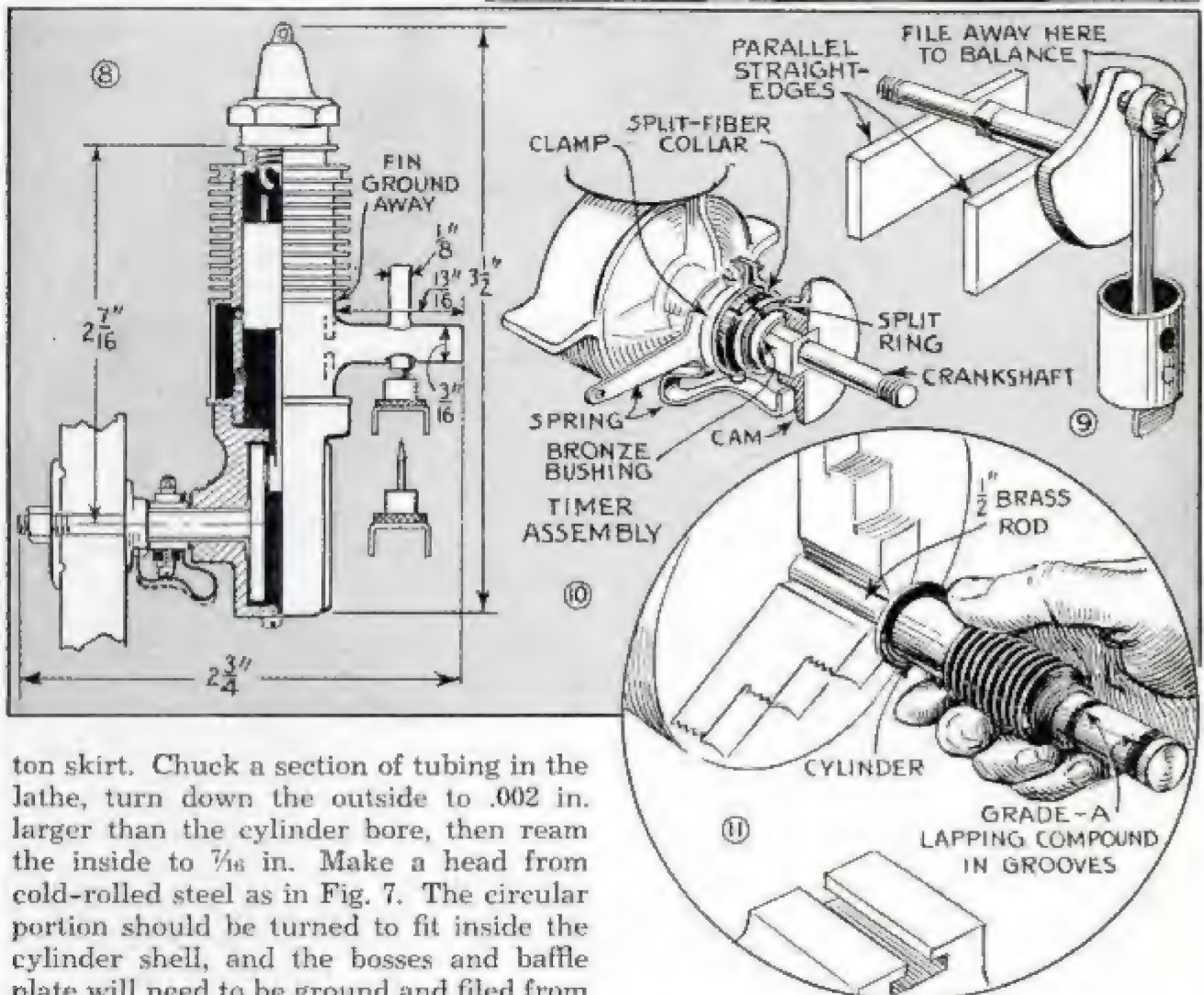
dimensions of the cylinder are given in Fig. 4. The second operation is to turn down that section of the cylinder between the base and fins. The latter are only $\frac{1}{64}$ in. thick, and the space between them is $\frac{1}{16}$ in. wide so you will need a $\frac{1}{10}$ -in. parting or cutting-off tool to do this job, Figs. 5 and 17. There are nine fins on the cylinder and three on the head. The fourth operation is

hardened by heating to $1,600^{\circ}\text{F.}$ and dropping in water. The degree of heat can be determined by checking its color with that of a chart. Next is lapping and polishing the bore. Turn a brass rod to a sliding fit in the cylinder. Cut two grooves as shown to carry abrasive. Chuck the rod and apply grade-A lapping compound in the grooves, Fig. 11. Start the lathe and slip the cylin-

der over the rod, holding it in the hand and working back and forth. As soon as the cylinder slides freely on the revolving rod and has taken on a high polish, it is finished.

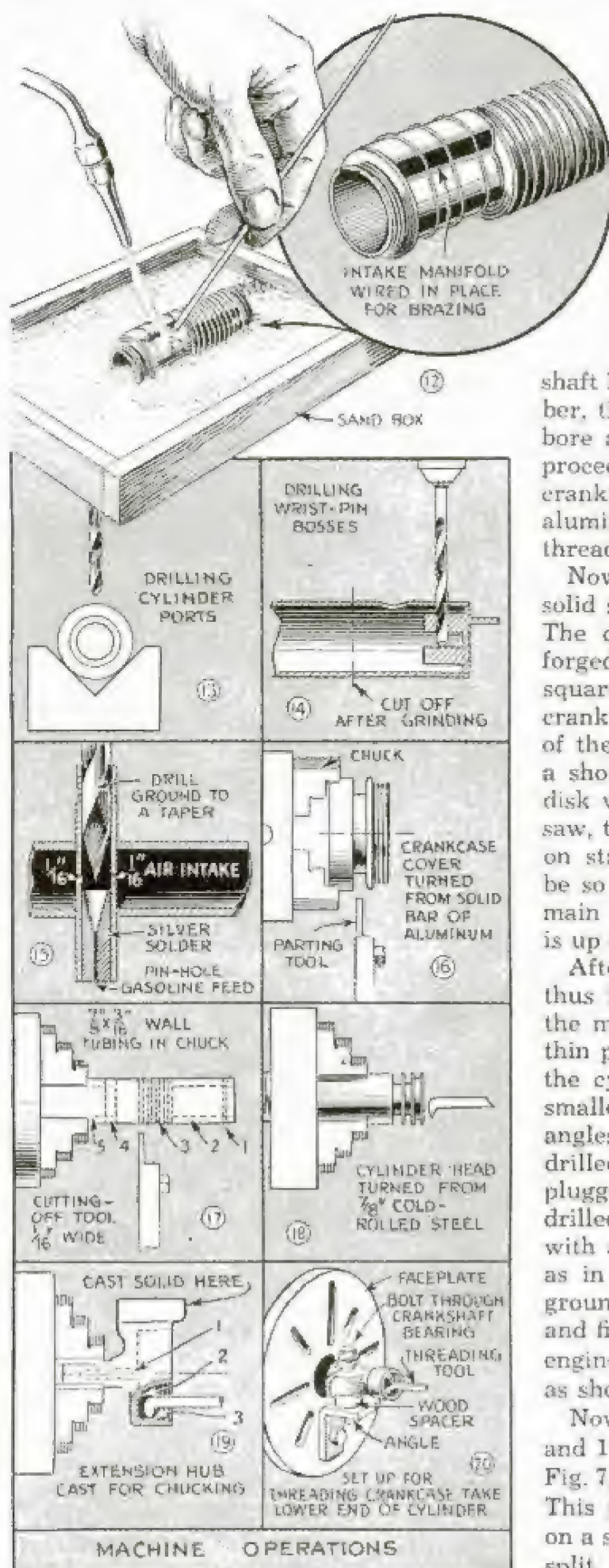
The cylinder head is turned from a solid bar of $\frac{7}{8}$ -in. cold-rolled steel as in Fig. 18. Bore the large and small inside diameters, Fig. 4, and then cut the threads and fins, and finally cut off to exact length. The head need not be hardened or polished but make sure that it seats true on the top of the cylinder, as no gasket is used.

Steel tubing, $\frac{9}{16}$ in. in diameter with a $\frac{1}{8}$ -in. wall makes the pis-



ton skirt. Chuck a section of tubing in the lathe, turn down the outside to .002 in. larger than the cylinder bore, then ream the inside to $\frac{7}{8}$ in. Make a head from cold-rolled steel as in Fig. 7. The circular portion should be turned to fit inside the cylinder shell, and the bosses and baffle plate will need to be ground and filed from the solid if you have no milling equipment. Braze in the head, drill for wrist pin and port, Fig. 14, and then harden by the same process as used for the cylinder. A groove should be cut at the base of the piston to make it easier to cut off after hardening.

Chuck the piston in the lathe and grind with a tool-post grinder until it can just be started into the cylinder, after which it should be lapped in to a close, but free-moving fit.



Make a wood pattern for the bronze connecting rod somewhat thicker than finished dimensions so that there will be enough stock for smoothing up and polishing with file and buffer. In making a pattern for the aluminum crankcase, Fig. 7, extend the crankshaft-bearing hub 1 in. so that it can be chucked for turning. No cores are used, the top section being cast solid, then drilled out as in Fig. 6. First bore the crank-

shaft bearing, turn the inside of the chamber, then thread, as shown in Fig. 19. To bore and thread the top for the cylinder proceed as in Fig. 20. A cover for the crankcase is turned from a solid bar of aluminum, as in Fig. 16, and cut off after threading.

Now a bronze bushing is turned from solid stock to a press fit in the crankcase. The crankshaft is turned from a drop-forged bar and has two diameters with a squared section between. See Fig. 7. The crank is a separate piece brazed on the end of the shaft, which has been turned with a shoulder. This crank is simply a steel disk with sections cut away with a hacksaw, then gradually filed down to balance on straightedges, as in Fig. 9. It should be so accurately balanced that it will remain in any position whether the crank is up or down.

After a trial assembly of all parts made thus far, disassemble so you can put on the mixing valve. This unit consists of a thin piece of $\frac{3}{16}$ -in. steel tubing brazed to the cylinder over the intake port, and a smaller tube running through it at right angles, as in Figs. 3 and 8. The latter is drilled for air passage, and one end plugged with silver solder. It is then pin-drilled and a needle-valve seat formed with a drill ground to the required taper as in Fig. 15. The needle valve itself is ground from a $\frac{1}{16}$ -in. phosphor-bronze rod and fitted with a screw cap. Note that the engine is mounted in an inverted position as shown in the photo above Fig. 1.

Now for the ignition assembly, Figs. 7 and 10. A square hole is filed in the cam, Fig. 7, and one section of the hub flattened. This permits the spring to make contact on a screw head, completing the circuit. A split collar is clamped tightly on the

bronze hub to maintain spark timing. The split-fiber collar is clamped by the brass band to which the ignition wire is soldered.

As this engine is designed to operate at sustained high speeds, accurate machining and fitting of all moving parts is of the utmost importance. It is of equal importance that the piston and by-pass ports register perfectly at the bottom of the stroke. For this reason the thickness of the gasket between the cylinder and crankcase must be checked carefully. A thin gasket is also used under the crankcase cover. The standard model-airplane spark plug is already provided with a gasket. In testing the engine it should be mounted solidly, equipped with a 10-in. propeller, and the current supplied by two or three dry cells and a conventional coil. The large batteries will supply ample current until you get it down to a fine adjustment. Fountain-pen flashlight batteries will suffice after the engine has been mounted in a plane. Of course, it is understood that oil is mixed with the gasoline—about one-tenth volume oil.

False Lock Keeps Loiterers Out of Building

A contractor who stored heavy equipment in a shed near the job, found that it was inconvenient to keep the building locked, as several workers had to have access to the place and there were not enough keys for all. As the contents could not be stolen easily, but it was desired to keep loiterers out, he used a false lock, as shown. An

ordinary hasp was used, and from this the hinge pin was removed and a loose pin substituted. The padlock was left locked in place and access gained by merely employing a nail to lift the hinge pin from the hasp.—G. E. Hendrickson, Argyle, Wis.

When a caster in a chair or couch becomes loose fill the hole with wood putty and insert the shank of the caster in it. When the putty hardens it will hold firmly.

Stencil to Paint Signs on Buildings Has Gutter to Catch Paint

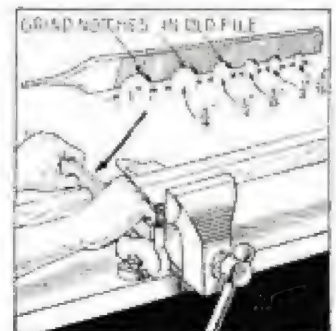


Gutter on bottom of sign painter's stencil catches surplus paint to avoid marring finished work

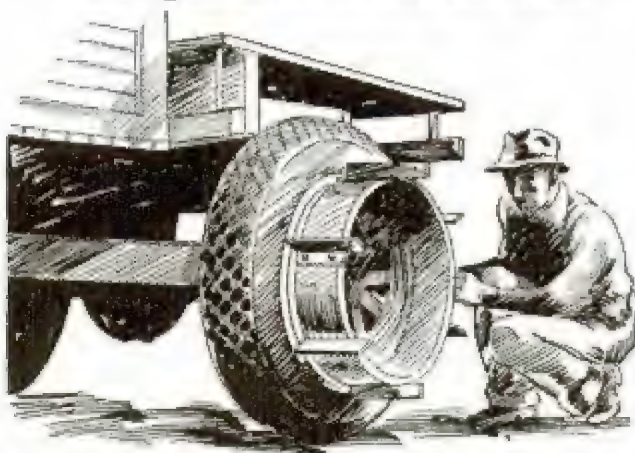
When stenciling a sign on a building or fence, a sign painter provided his stencils with a gutter at the lower edges to catch the surplus paint that might otherwise run off the stencil and mar the appearance of the building or fence on which he is working. As most stencils used for this purpose are cut from sheet metal, it is an easy matter to bend up the lower edge to form the gutter. If this is not desirable, however, a small gutter can be shaped from a strip of metal and soldered to the lower edge of the stencil.

Spokeshave Made from File

For rounding the edges or ends of work, or for giving them various other shapes, a handy tool can be made from a file. All that is necessary is to first grind the sides of the file to make them smooth, and then grind several notches in one edge, as shown. These notches can be of various sizes to suit your particular needs.



Mail Carrier's Car on Rural Route Has Special Wheels for Mud

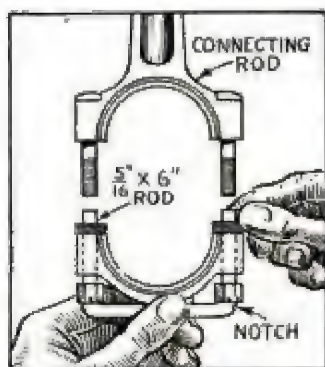


Rural mail carrier travels on both hard and muddy roads without using tire chains

On my job of carrying mail over dirt roads of a rural route, I use the wheels shown when the mud is deep during fall and spring. The vehicle is a light truck stripped of body to reduce weight, and fitted with oversize wheels. To the rear wheels are bolted wide extensions made of discarded wheel rims. The extensions are fitted with angle-iron lugs, which clear the road by 7 in. on dry ground. This arrangement permits the car to travel normally on firm ground, but when the roads are soft so that the tires sink in the mud, the extensions ride on the sides of the ruts, affording good traction.

—Vine Stoddard, Jesup, Ia.

Bearing-Cap Tool Keeps Shims in Correct Order



When bearing caps are removed with the shims, slip them on this holder, which shows exactly how to replace them correctly, and also keeps the shims from being lost. The tool consists

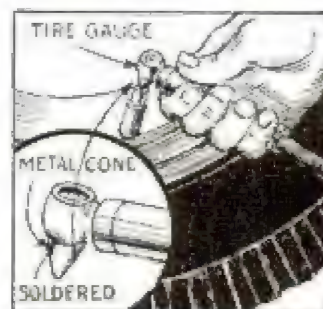
of a length of iron rod bent to a U-shape with the legs the same distance apart as the bearing bolts, a notch being filed in one leg to serve as a guide to replace the bearing correctly. In use, the bearing nuts are removed, after which the tool is held under the bolt ends with the notched leg

toward the cam shaft. The bearing cap and shims are then slipped down onto the tool where they are held until returned to the bearing.—Robert E. Davy, Represa, Calif.

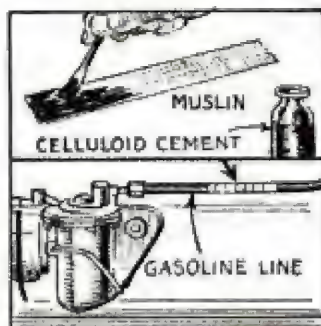
Cone-Shaped Piece on Gauge Lets Air Out of Tire

It's a simple matter to solder a small, cone-shaped piece of tin to the top side of an air gauge to use in compressing the valve in the tire.

The cone piece is always at hand when needed, and it should be flattened slightly at the pointed end to engage the end of the valve core easily.



Fractured Gas Line Repaired with Cloth and Cement



An emergency repair for a cracked gasoline or oil line that will last until a new pipe can be installed is made easily with a strip of muslin and celluloid cement.

Clean the line thoroughly around the break, coat the muslin with the cement and wrap it tightly around the crack.

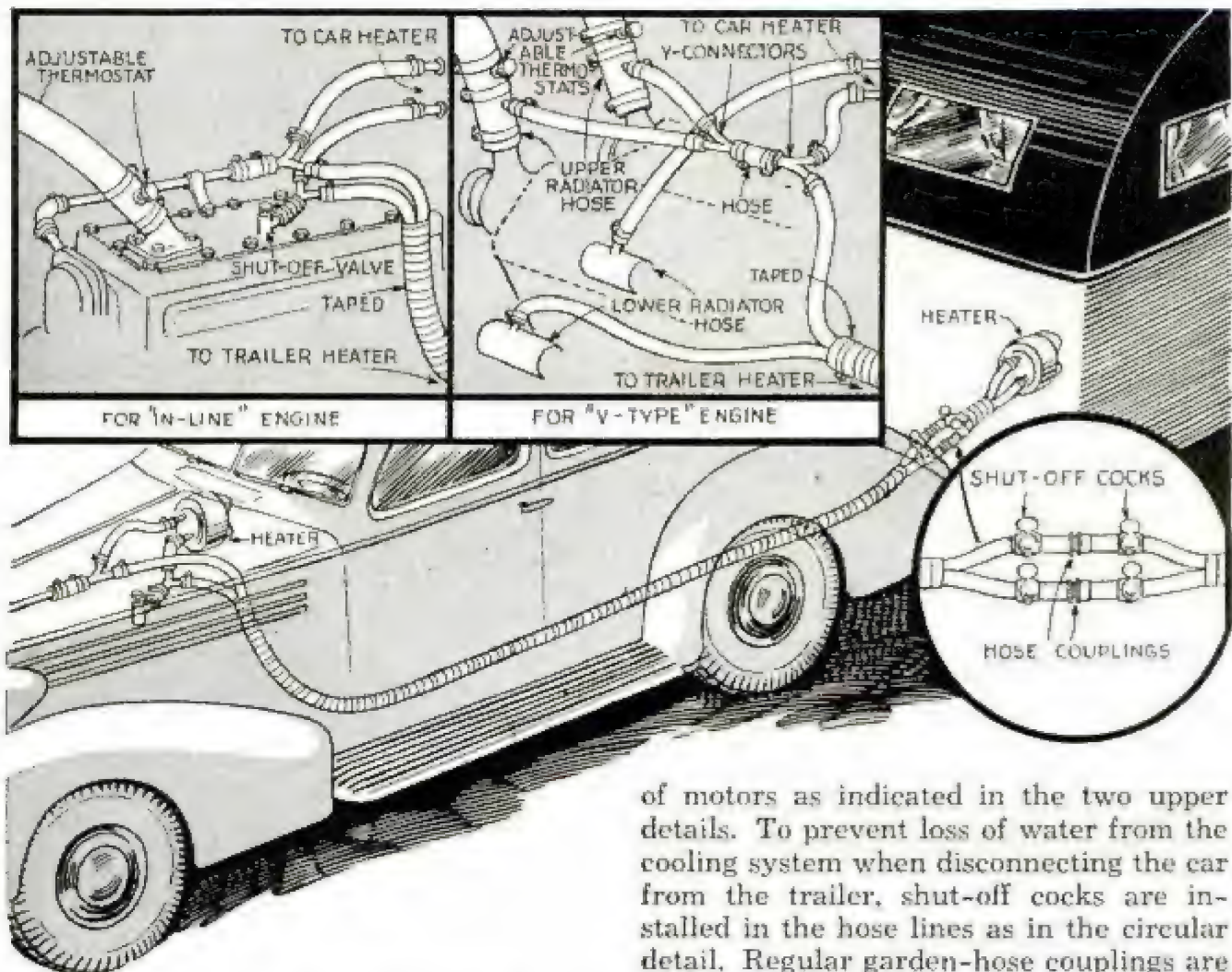
Glare Shield Hinged to Visor

An excellent position for a colored celluloid glare shield on a car is to hinge it to the back of the regular sun visor so that it can be folded out of the way when not in use. As the visor is adjustable, it can be



raised or lowered to hold the shield at the right height to suit any driver.

Auto Hot-Water Heater Installed in Trailer

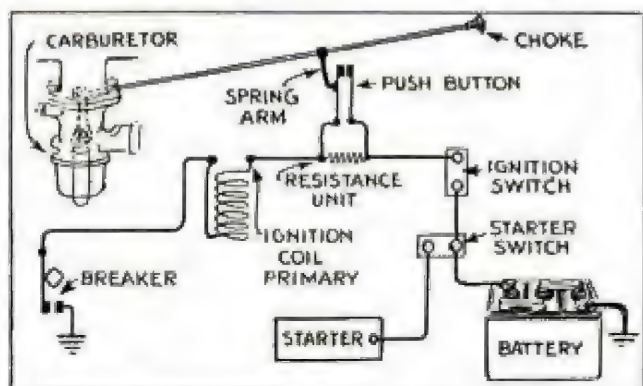


Using his trailer the year around, one man heats it in winter with hot water from the water circulating system of the car. A bus-type, hot-water heater in the front of the trailer is connected to the car motor by $\frac{3}{4}$ -in. heavy-duty garden hose, the connection being made to the different types

of motors as indicated in the two upper details. To prevent loss of water from the cooling system when disconnecting the car from the trailer, shut-off cocks are installed in the hose lines as in the circular detail. Regular garden-hose couplings are suitable for making the connections. The hose should be taped together wherever possible, and the entire line completely wrapped with asbestos to conserve heat. Also, it should be fastened securely every 3 ft. Where frame members permit, the hose may be taped to them and the tape varnished.—C. E. Packer, Chicago.

Automatic Switch on Choke Rod Improves Ignition Spark

A switch or push button to automatically "short out" the ignition primary resistance unit when the choke is pulled will increase the intensity of the spark and help improve hard starting in winter. The switch should be mounted firmly near the choke rod, to which is fastened a spring finger that will close the switch contacts when the choke is pulled. Two wires leading from the switch to the resistance unit as shown, complete the job. The resistance should not be shorted out permanently, or the breaker points will be burned.



Switch to automatically cut out coil resistance unit when choke is used helps start car

How to Butt-Weld Metal Plates to Prevent Warping



Ends of plate metal to be butt-welded raised on block to prevent warping as the job cools

Have you ever tried to butt-weld two pieces of fairly thick metal and found that after the job cooled the weld was warped considerably out of true? If so, you can avoid this next time by butting the pieces together on a thin block as shown in Fig. 1. Then when the welding job is done and the normal amount of warpage takes place as the metal cools, it will be straight. It will take some experimenting to determine just the thickness of block needed to take care of the warpage of the particular type of metal being welded.

—L. H. Georger, Buffalo, N. Y.

Study of Streamlining Aided by Aluminum Powder

To aid in studying streamlining, students at one school of science constructed a "flow" tank and filled it with water, on which aluminum powder was sprinkled. Models to be tested are drawn through the water, and a high-speed camera is used to photograph the wake. In this way, a graphic record is available for future reference.

—John A. Marotta, Cleveland, Ohio.

The Next Issue

CHRISTMAS CARDS WITH A PERSONAL TOUCH

Make your own cards and give them a personal touch that can't be purchased. Story includes making them by using block prints, cutouts, embossing or by the popular photographing method. Also tells how to make envelopes.

CAN YOU TURN A WOOD SPINDLE ACCURATELY?

Step-by-step procedure in turning wood spindles, the groundwork of all lathe jobs, from centering the work to making the finishing cuts of various types.

DIAGNOSING YOUR HEADLIGHT ILLS

How to check, focus, clean and repair your headlights to give you a safe driving light that is not offensive to your fellow motorists on the road

HOMEMADE BALL-BEARING SHAPER

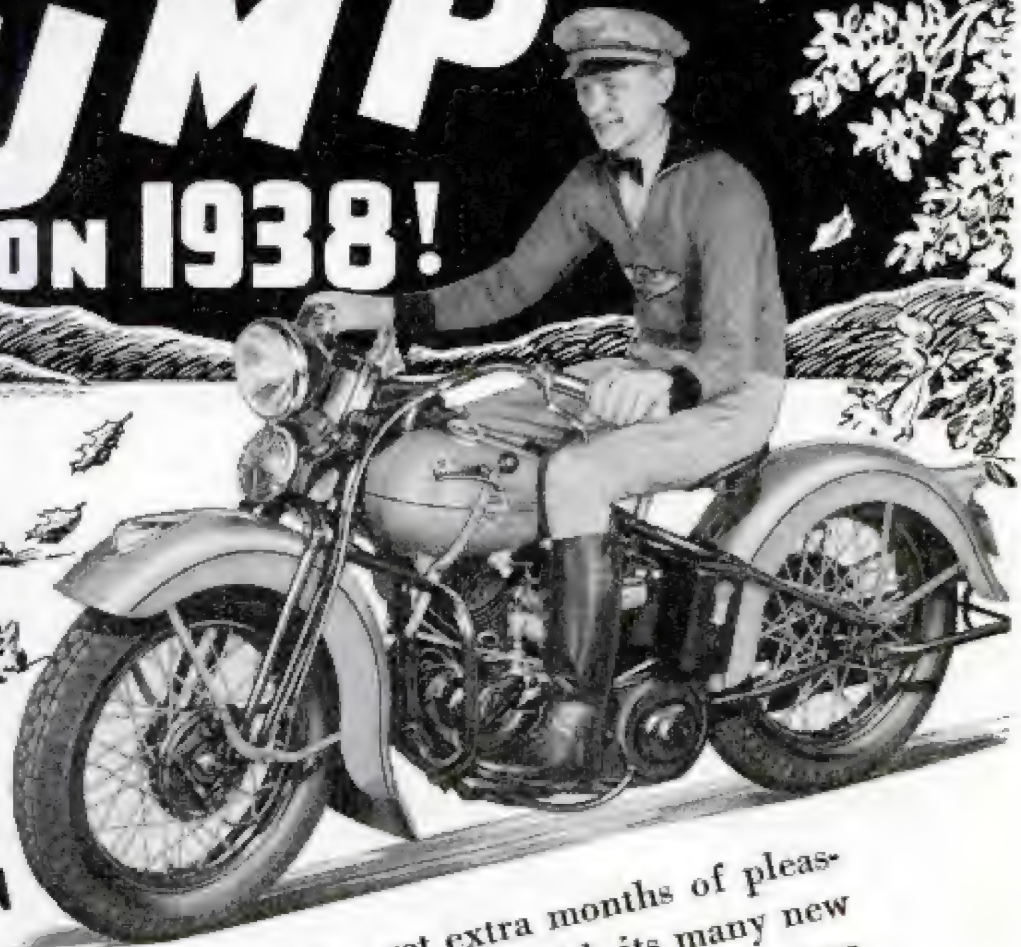
An inexpensive shaper that can "take it." Shaft takes three-lip cutter which is easily obtainable and rotates in a lubricant-filled container that is dustproof.

BUILT-IN BOOKCASE

With its broken pediment, fluted panels and Grecian urn, this bookcase makes a fine piece of furniture that is deserving of a corner in any home.

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**RIDE A 1938
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Address.....

My age is () 16-19 years, () 20-30 years,
() 31 years and up, () under 16 years.
Check your age group.

HARLEY- DAVIDSON

Making Movies True to Life

(Continued from page 709)

mercury type of barometer and is also used for the other.

"Again, in a South Sea island picture the type of pidgin English spoken by the natives depends upon the location of the island. It is correct for a Hawaiian to say 'akas' for 'ax' and 'akas he come and go' for 'saw,' but that would be wrong if the scene were laid in Samoa where the natives can't pronounce the letter 'K'."

Besides using the Hollywood technical experts the studios are apt to call upon almost anyone else available who happens to have special knowledge that they need. Astronomers, telephone technicians or

Japanese pearl diving scene to a close-up of an African wild animal.

Research starts as soon as a story is decided upon and the art director has listed the backgrounds he will want. The list may include an English inn, the interior of a bus, and a French railroad station. General pictures of such scenes are assembled first and then comes the work of tracing down details like a porter's costume, a railroad station schedule board in French, and furniture for the inn. From then on until the picture is finished the research department may be called upon at a moment's notice to provide more information. When the right answers can't be found in the file, telephone calls or cables usually bring them within a few hours.

Nearly every picture that is released contains a minor mistake or two but almost all of these result from compromises in the studio instead of from carelessness. A director may decide that the additional expense of equipping a whole troop with exactly the same kind of rifle is not worth while if the property department happens to have a lot of rifles on hand that look almost the same. The director puts the property rifles in the rear ranks where not one person in a million is apt to notice them.

Sound pictures have increased the amount of research necessary in the studios. Songs, dialects, and speech as well as architecture and costuming must be correct. Color is adding other difficulties and here the studios sometimes have to compromise with realism to prevent color clashes that would not look well on the screen. The day of such obvious mistakes as Caesar reaching for a telephone or a modern street sign in old Babylon is past but directors are constantly on the lookout for minor slips that might spoil the effect of a picture. The two articles that give directors more trouble than anything else are wrist watches and tennis shoes. If a watch or tennis shoe is worn carelessly by some extra in a costume mob scene, the studio can expect to receive scores of letters pointing out the mistake.

Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.



Expert repairing flint firing mechanism of a long rifle in the studio armory

railroad men may get calls to help direct when a studio finds that it needs technical advice along such lines for a picture.

Picture books are the mainstay of the research department. From photographs or drawings the art department is able to create scenes that are true to life right down to such details as street signs or the proper pavement. Medieval castles can be imitated stone for stone, and from pictures a Chinese junk that no one could tell from an original can be created. Architectural books and magazines are the backbone of the research library and after those come books of costumes and others showing vehicles, weapons, and other items. Complete files of the world's most important magazines are kept on hand and several girls are always busy clipping photographs from newspapers that show anything from a

America's fastest growing hobby

SNAPSHOTS at NIGHT

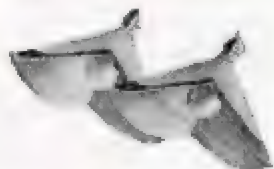


Just do this

1. Load your camera with Kodak "SS" Film



2. Use two or three Photoflood lamps in Kodak Handy Reflectors



LITTLE SISTER poses in her crib... the older children at their games... the grown-ups around the fireside... and the family camera clicks busily away, recording the important side of life that's lived after dark—indoors.

You don't need an expensive camera for snapshots indoors at night—not any more. Any camera that can be

loaded with Kodak "SS" Film will do the trick—even the simplest Brownie.

With "SS" Film, use two or three of the new No. 2 Mazda Photoflood lamps, which last for hours, in the inexpensive Kodak Handy Reflectors. If your camera has an *f.6.3* or faster lens, No. 1 Photoflood lamps are powerful enough.

FREE BOOKLET . . . Suggests a variety of picture opportunities . . . shows you how to arrange your lights . . . how to place your subject . . . tells you everything you need to know about two ways to make night pictures—*snapshots* with Photoflood lamps, *fast exposures* with Photoflash lamps. (You can use Photoflash lamps, each good for one picture, if your camera can be set for "time.") Be sure to get a free copy at your dealer's . . . Eastman Kodak Company, Rochester, N. Y.



When writing to advertisers please mention Popular Mechanics

Dynamite—Man's Mighty Slave

(Continued from page 661)

demns gasoline. Many make the mistake of classing dynamite with smokeless powder, picric acid, T.N.T. and other war explosives but dynamite's sensitive qualities make it unsuitable for shells and its disruptive force would shatter any rifle or cannon. Like blasting powder, it is an industrial explosive employed for constructive purposes. In consumption it far outranks military explosives. During the last ten years explosives for warfare have averaged only about three per cent of those produced for mining purposes.

Nearly a century ago an Italian chemist treated glycerin with nitric and sulphuric acids and obtained an oily, highly explosive and very unstable liquid which was used almost immediately for medicinal purposes. This new "medicine" was nitroglycerin, later to become the active ingredient of dynamite.

For years nitroglycerin remained little more than a scientific curiosity. Then Alfred Nobel, of peace prize fame, mixed this unstable liquid with an absorbent earth. The result was a more stable explosive which could be detonated with a blasting cap. He called it "dynamite" and presented it to the world as a new industrial tool.

Except for electricity and light, dynamite probably exhibits the highest speed of anything associated with this earth. The detonation of dynamite is not instantaneous. Lay sticks of dynamite end to end and start a detonation at one end and it travels, at a measurable rate, down the line. Many dynamites exhibit a detonation speed of 18,000 feet per second.

Dynamite is not as mighty as some assume. Many believe a couple of sticks would wreck a city block but during the San Francisco fire when dynamite was used to wreck buildings, from 300 to 600 sticks were employed to raze one ordinary frame structure. A quarryman who explodes a pound in solid rock usually is satisfied to get four tons of broken stone and in ditch blasting, a pound is expected to throw out about one cubic yard of dirt.

Substituted for Nobel's absorbent earth in modern dynamites is a mixture of ingredients intended to serve as an active "dope" to assist in the explosion as well as to form an absorbent for the nitroglycerin.

Many kinds of dynamite are produced today. E. I. du Pont de Nemours and Company alone makes 150 kinds varying in blasting strength, speed of explosion, charging density and ability to withstand immersion in water. Some kinds are plastic, some are granular and some are so free-flowing that they can be poured into drill holes.

One of the disadvantages of early dynamites was that they froze at temperatures of forty or fifty degrees above zero and a miner's cabin sometimes went up with a bang while he was trying to thaw out the explosive in an oven. Today an anti-freeze compound in dynamite prevents freezing even at fifty or sixty below zero.

Making dynamite is not a complicated process, but making it safely requires both adequate equipment and long experience. The nitroglycerin in a modern plant is produced in a nitrator, a steel tank equipped with brine coils. Glycerin is added to the nitric and sulphuric acids while mechanically driven paddles agitate the mixture and the brine coils carry off the heat generated. A modern nitrator produces about 3,000 pounds of nitroglycerin at one operation, using about 7,000 pounds of acids and about 1,200 pounds of glycerin in the process.

The mixture passes to a lead tank where it stands until the acids settle. Then the top is drawn off and purified by washing to free it of any traces of acids. Copper-lined, rubber-tired "buggies" pushed by hand convey the nitroglycerin to a mixing house where also goes the "dope" or absorbent material prepared by mixing and screening dry and ground nitrate of soda, nitrate of ammonia, wood pulp, flour, sulphur, starch, chalk and other ingredients.

The dope and nitroglycerin are brought together in a dynamite mixing machine, a great wooden bowl in which revolve wooden wheels to knead the mixture. These wheels are edged with rubber and overhead wooden pulleys supply the driving power, obviating the possibility of metal-to-metal friction. The product which comes from the mixing machine is loose dynamite.

With wooden shovels it is removed to

(Continued to page 118A)

"Hello, handsome!..."

...I like your Barbasol Face"

Do you want to make a hit with your wife or sweetheart or a certain little pet you've got a yen for?

Then throw away old shaving methods and switch to modern Barbasol.

Try this wonderful cream for just two weeks and see what an improvement it makes in your face.

Note how much softer and smoother your skin feels, how roughness and wrinkles seem to clear away—how much younger you look with a Barbasol Face!

For Barbasol contains none of those harsh alkalis that dry out the skin, make it feel drawn and taut after shaving—alkalis that irritate, roughen and wrinkle.

Barbasol is a soothing cream, very beneficial to the skin. First it prepares your beard for a

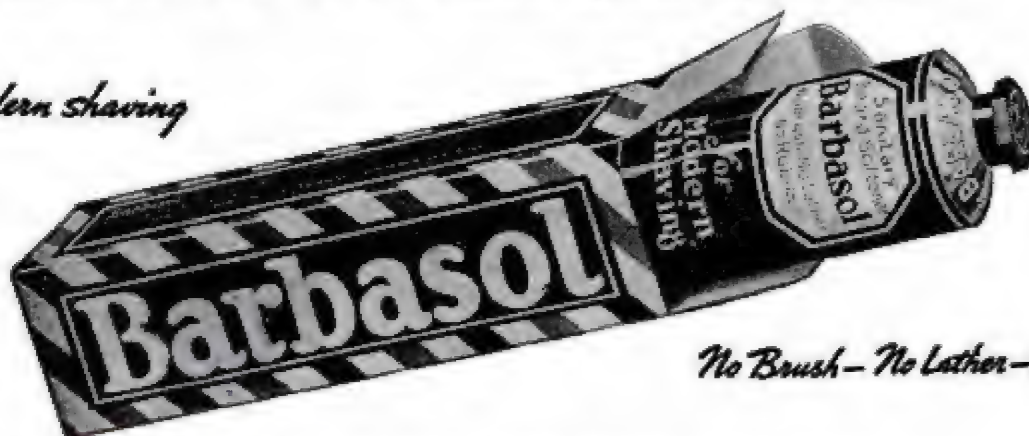


mighty sweet shave, and then it leaves your skin as soft and supple as seventeen.

Ask your druggist now for Barbasol. No brush, no lather,

no rub-in—it's America's fastest-selling shaving cream. Large tube, 25¢; giant size, 50¢; family jar, 75¢. Barbasol Blades, 5 for 15¢.

For modern shaving



No Brush—No Lather—No Rub in

(Continued from page 116A)

wooden tubs and transported to a packing machine where it is tamped mechanically with rubber-tipped wooden tamps into the paraffined paper shells. A modern packing machine handles about 40,000 pounds of dynamite in eight hours. The packed cartridges are carried in wooden tubs to a packing house where they are placed in boxes which are nailed shut by an automatic nailing machine. The boxes then go to a magazine to await shipping.

And if you want to live to a ripe old age, you might do worse than get a job in a modern dynamite plant. Because the inherent hazards are recognized and every precaution is taken to prevent accidents, an up-to-date dynamite plant is virtually a foolproof place to work. "Safety first" is a slogan which means exactly what it says in an explosives factory.

In the early days of making dynamite, accidents were more or less frequent due to improper equipment, inadequate spacing of buildings and inexperience of workmen. Today serious accidents are rare indeed. Since one careless man can make the best plant unsafe, safety really begins with the careful selection and long training of employees.

The plant is usually located far from towns and villages, buildings are spaced far apart and each operation is confined to a separate structure. Those in which hazardous work is performed are barricaded with mounds of earth to localize damage if an accident occurs.

The most dangerous operation, of course, is making the nitroglycerin. The heavily barricaded nitrating house usually has a floor covered with rubber and the workmen wear rubber-soled shoes. Doors open outward, sometimes the roof is hinged to swing upward and there is a chute to facilitate speedy exit in an emergency.

Men with long years of experience work in the nitrating house and only a few are present at any one time. One man keeps his eyes glued to a big thermometer because a sudden rise in the temperature of the mixture is a danger signal. Any interference with the important stirring operation is guarded against by an auxiliary means of mixing.

And should anything appear to go wrong with a batch, the operator pulls a lever which dumps the contents of the nitrator,

"drowning" it in a pool of water. Many operators develop an uncanny sixth sense which seems to warn them when trouble is brewing. When they get such a hunch, they act and act fast. Later they just smile and remark that "things didn't look just right, so I dumped her."

Rubber, felt and wood replace metal on machines and equipment coming in contact with explosive components of the dynamite. Shut-off valves or spigots of metal or wood are not used on the nitroglycerin tubs. Instead, a wood clamp stops the flow of the liquid through a rubber hose. Weights for weighing are covered with rubber, compressed air supplies much of the power and the rubber-tired buggies in which the nitroglycerin is transported to the mixing house are pushed along smooth board walks, and signals and semaphores prevent two buggies from getting in the same "block" and colliding.

All materials going into the "dope" are screened to eliminate foreign particles and an electromagnet picks out bits of iron or steel. The wooden wheels of the dynamite mixer are equipped with rubber rims and wooden shovels are used exclusively in the mixing and cartridging houses. Workmen wear clothing devoid of metal and must check matches at the gate.

Such vigilance and safety regulations have all but eliminated accidents in modern explosives plants. Millions of pounds of dynamite are not only made safely, but transported safely each year. During the past fourteen years more than 3,000,000,000 pounds of dynamite have been shipped over millions of miles of American railroads without injury to a single person and with virtually no damage to property. And in the hands of an experienced blaster equipped with modern blasting apparatus, dynamite today probably is no more hazardous than any other industrial tool. In fact, one blaster who has set off tons of dynamite refused point blank to set off his son's Fourth of July firecrackers.

"I know what dynamite will do," he explained, "but I don't know what these cannon crackers might do."

Dynamite has been one of the great constructive forces of the twentieth century. New tasks are being found for it daily and without it, our modern civilization would be impossible.



*Any
way you
smoke it*



**FIVE REASONS WHY
YOU'LL LIKE VELVET**

1. Fine old Kentucky Burley aged-in-wood.
2. Flavored with pure maple sugar for extra good taste.
3. An altogether different fragrance.
4. Cut to pack easy in a pipe—cut to roll smooth in a cigarette.
5. Every tin contains 2 full ounces.

*it's better
smoking
tobacco*



Housekeeping in the Clouds

(Continued from page 715)

yard wide. Pilots make night landings with a particularly gentle touch so as not to disturb passengers. One of the problems for the tactful hostess these days is the passenger who snores so loudly that he disturbs other sleepers. Inside the sound-insulated cabin of the plane the noise of the motors is merely a distant hum.

The projected four-motor super-transports which the air lines are going to use a couple of years from now will be even more comfortable, for instead of landing at an angle they will land level with the ground. Berths will be horizontal all the time. This is going to be made possible by landing the plane on its two conventional wheels plus a third wheel let down from the nose of the plane. The tail of the airplane will remain in the air during a landing. These planes will be so large that at least two stewardesses will be necessary.

The stewardess of a sleeper plane has more than 1,000 items of equipment in her charge, including spare bedding for changes to be made when new passengers board the plane, a berth ladder for getting into upper berths, coat hangers and special clothes hangers for use in the berths. Her equipment includes soap, paper towels, paper drinking cups, extra blankets, shopping bags for stowing away debris that might clutter up the cabin, a fly swatter for flies that might hop into the plane during a ground stop, and a small broom for keeping the aisles clear. In her charge is a bottle of disinfectant for sterilizing the electric razor that operates off the ship's current, a portable typewriter, current magazines and the latest editions of newspapers, several games and a medical kit.

At Kansas City, if you wish to telephone from the plane while it is on the ground, the stewardess connects the plane's phone with the ordinary land wires through the airport exchange. So far, passengers can telephone from a plane only while it is on the ground, since not enough radio channels are available for radio telephone service for ordinary conversations.

In the air, however, the hostess answers the phone in the galley that connects with the pilot's cockpit to get the latest weather information and other reports the pilots think the passengers might like to know.

Besides being a registered nurse, each hostess must know much about aviation and be able to answer almost any question a passenger might ask. She must be able to explain intelligently how an airplane stays in the air, what the automatic pilot does, and even outline the air mass analysis system used in weather forecasting. The hostesses are thoroughly trained for their work at a ground school that is part of the air line's system.

Spring cleaning in the air comes at the end of every transcontinental trip. While mechanics are swarming around the engines, other members of the ground crew remove the rugs and seat upholstery from the cabin. Then the entire interior is cleaned with a huge vacuum cleaner. Mirrors and toilet fixtures are polished, used linen, bedding, and dishes are removed, and the galley is cleaned out. In the hangar the rugs and upholstery are brushed and cleaned. Spots are removed with solvent. Fresh supplies are put back in the plane, and after the cleaned rugs are laid down, canvas is placed over them to protect them from the shoes of mechanics hurrying back and forth to the cockpit.

Then the plane is ready to be washed. The ground crew wheels it out of the hangar and goes after the exterior with a fire hose, buckets of soapy mixture, and half a dozen long-handled brushes. Every inch of the fuselage and wings is scrubbed and the windows are polished. Finally the plane is ready for inspection and another flight, immaculately clean inside and out.

Combined Light and Bug Trap Handy for the Home

While supplying efficient light for ordinary purposes, an attractive new lamp serves as an insect trap. The diffusing glass of the lamp is pierced

by three slots, with all surfaces curving inward, through which the insects enter to be destroyed by the superheated air created by the bulb.



The Miller Co.
Meriden, Conn.

MADE NOT FOUND

WHEN YOUR CAR was still in the blue-print stage, Socony-Vacuum research men worked with automotive engineers to make Mobiloil best for your motor.



THE REAL REASON
MOBILLOIL IS
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MOBILLOIL AND MOBILGAS

SOCONY-VACUUM OIL COMPANY, INC.



“Souping Up” the Waterbugs

(Continued from page 877)

“Stepping up the revolutions of a motor from 6,000 to 7,300 is no easy job,” the racing expert says. “Every part of the motor must be in perfect alinement. To provide greater durability and to reduce friction, the cylinders are chrome-plated and the pistons fitted with infinite precision. High-tension rings are substituted so better compression can be obtained with the throttle wide open. Frequently, special carburetors are installed and new gas passes opened.”

From a racing standpoint, present motors are at least seven years behind the times, Neal says. An up-to-date one, em-

costs about \$225 and the hull, \$175. Add to this an automatic throttle control, racing apparel, knee pads, fire extinguishers, and a trailer unit on which to transport the boats and you have a fair idea of the initial cost. This doesn't take into account association and registration fees, traveling expenses, repairs or fuel. Then, too, motors occasionally burn out and replacements come high. Spark plugs must be changed frequently.

Amateurs race for cups and medals, professionals for money. Those of the latter group are not professionals in the strict sense, as there isn't a driver in the game who makes his living out of racing. Their winnings only help foot the bills. A racer can pick his company, competing in the puddle regattas or the big time. The prizes are awarded on the basis of heats and range from \$5 to \$75 a race. The second and third prizes are scaled in proportion.

The greatest money-maker is Fred Jacoby, Jr., 1935 and 1936 high-point champion, who, in 1935, won more events and more money than any driver in the last twelve years. His winnings totaled \$2,655 but after he had tabulated his expenses for the season he discovered he was just \$200 in the red.



Bottom of outboard racer, showing small step and overlapping longitudinal steps

bodying a few of the improvements and discoveries of the last six or seven years would be productive of incredible marks, he believes.

Such a radical change in motor building is not likely to come about for some time because present models are more than adequate for the average sportsman. Because no motor can be recognized by the racing body until it has been put into production and twenty-five models sold, the aces may have to wait some time to blaze new speed trails.

The outboard fan spends weeks and months in preparation for the few hours of actual racing he does. The excitement of waterbugging comes high, too. In Class A, for example, a driver needs a 100-pound racing hull, driven by a two-cycle, two-cylinder engine capable of doing around fifty miles an hour or better. The motor

Wire Spring Guards Manhole When Cover Is Lifted

Automatically on the job the moment a manhole cover is lifted, a spring steel wire guard pops up like a jack-in-the-box and prevents anyone from falling into the open hole. It extends three feet above the ground, and is anchored within the manhole. The tension is such that it can easily be depressed to let workmen enter. A warning flag can be attached at the top.



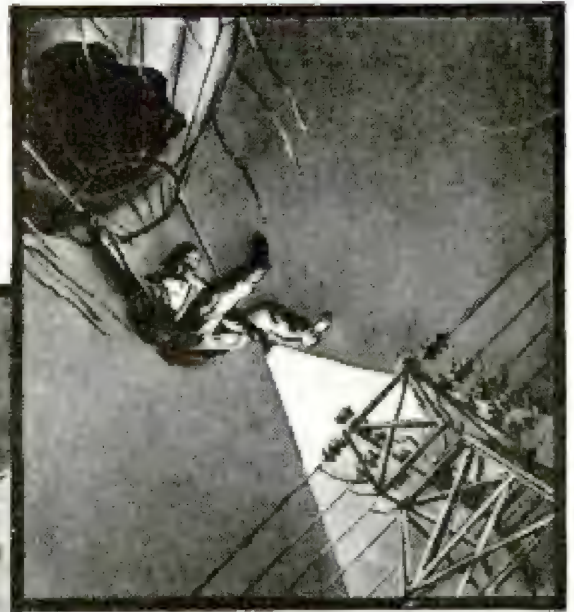
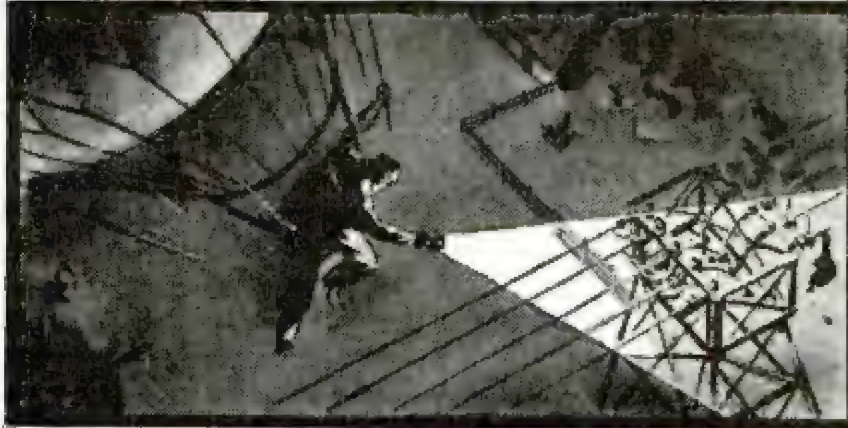
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Designed by E. A. Watson
Emphasized by Watson

Death Waited While He Hovered in the Sky!



**Crowd Waits
Electrocution
As Failing Balloon
Wafts toward Wires**



was going to set me none too gently down in a nest of hot, high-tension wires!

"I never did like jumping from balloons," writes G. W. de Grange, professional daredevil of Martinsburg, West Virginia, "and this time there was a mean wind to make matters worse."

"We finally got the hot air bag filled, and I took off in the dark from the fair grounds at Emmitsburg, Md., intending to make a parachute jump into the town square."

"But the balloon was soggy. She wouldn't give me altitude. I passed about 300 feet over the town square, and didn't dare to... the big bag began to slowly settle."

E. R. Watson

The home office of Employers Mutuals is at
Nausau, Wisconsin.

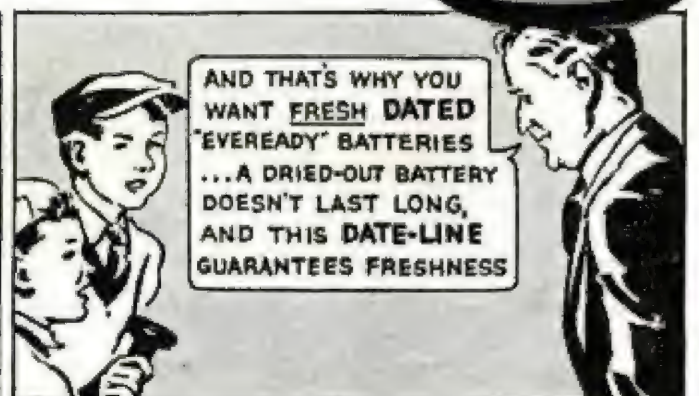
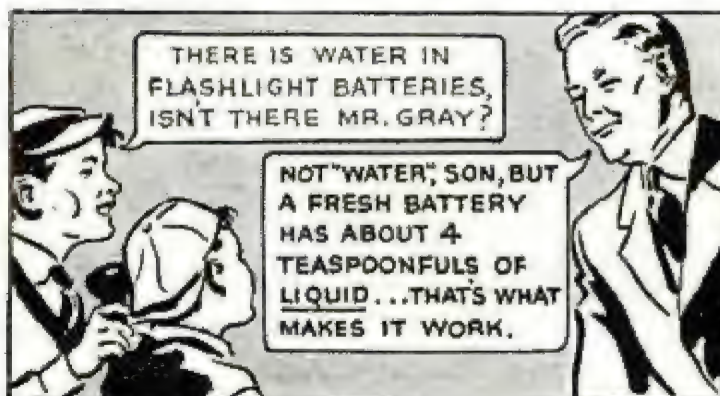
"I've sideslipped by these death-dealing wires with a 'chute many a time... but just imagine steering a lollopy big dying balloon by pulling on the shrouds. But I pulled with everything I had while the crowd waited for an aerial execution... and because those faithful, fresh DATED 'Ever-ready' batteries were on the job, and showed me the wires in time, I slid by certain death by inches! Without light the instant I needed it, that crowd would have got more than its money's worth. (Signed)

George W. de Grange

"EVEREADY" BATTERIES ARE FRESH DATED BATTERIES

The DATE-LINE guarantees FRESHNESS

NATIONAL CARBON CO., INC., 30 East 42nd St., New York, N. Y.



The Secrets of Night Driving

(Continued from page 669)

"Hold it or I'll kill you!" the bandit shouted, but the driver suddenly pushed the side door open and threw the hold-up man to the pavement.

By this time the bandit's companion had opened fire and the driver, now thoroughly aroused, found this a little too much to bear. Pulling out his own gun, he turned around at the next corner and bore down at high speed, blazing away at the pair as they beat a hasty retreat.

Chief E. Raymond Cato of the California Highway Patrol advises the night driver to beat this type of bandit to it by making it impossible for him to get a good hold.

"Keep all doors of your car locked and do not permit anybody to step on your running board," he advises.

Most of the late cars can be locked completely by reversing the door handles; but if your car doesn't, it is simple to lock yourself in with the key. It isn't very safe to have the windows completely down, either. It makes it too easy for a thug to attach himself to the side of the car. If the window's nearly up, a quick turn of the handle can pinch his fingers and make him let go.

In his tool kit the good night driver carries a few things that occasionally come in handy. There is a piece of celluloid which he can attach to the windshield in winter time to prevent snow and ice from freezing on it. Always, of course, he is careful to keep the windshield, front windows, rear window, and rear-view mirror clean. If a shatterproof window becomes badly shattered in some accident, he has it replaced to keep his view unobstructed.

Another gadget which he seldom uses but is worth its weight in gold when the time comes, is a set of flares to be lighted when he has to change a tire or make repairs on the road. Of course, he always pulls clear off the traveled portion of the roadway if it is possible, but sometimes it isn't, and anyway, the flare makes it impossible for an approaching car to fail to see him as he works. In an emergency, he knows he can make an improvised flare by filling a small can with sand or loose earth and pouring a little gasoline over it.

He doesn't make the mistake of overloading his car with fancy lights and spot-

lights to dazzle and confuse other motorists, but the chances are he will favor port-starboard lights on running boards, or perhaps prefers red glass buttons attached to the side of tail and headlights.

Maybe you'll find he carries one of the various types of automatic signaling devices to supplement hand signals, or perhaps uses an illuminated wand to point the direction of his turn. And when he has to walk the highway at night, he carries one of the "Boy Scout"-type flashlights with a red window in the side of the reflector, so that when carried in the hip pocket, the torch becomes a pedestrian taillight.

Best of all his qualities is the fact that he is a modest man and knows his own limitations. At the New York Museum of Science and Industry he was one of 350,000 persons who took a driving test on a machine that flashed different signals at them as they "drove" along a mimic roadway at a speed corresponding to forty miles an hour. He noticed that individuals responded so differently to signals that their stop distance varied as much as 150 feet. Experts there attributed these differences to poor vision, over-excitability, too high or too low blood pressure, and other factors.

Like most other drivers, he started the examination with a fair degree of self-confidence, but to his embarrassment, found that in steering tests he was able to keep the car on his own side of the "road" only sixty per cent of the time. He was quick enough on the trigger—his reaction time was a shade less than half a second; but he didn't score so well when a "pedestrian" suddenly appeared from the left side of the "road."

Later he had a chance to check up on this deficiency, when he took a state traffic test. Seating him facing a semicircular gray band of metal, the expert in charge asked him to look directly ahead at the center of the arc, while a small target was moved around the perimeter of the arc until he could no longer see it out of the tail of his eye. On the right side he was able to follow the target nearly a full ninety degrees; but on the left, it soon passed out of view and the expert told him

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Ship

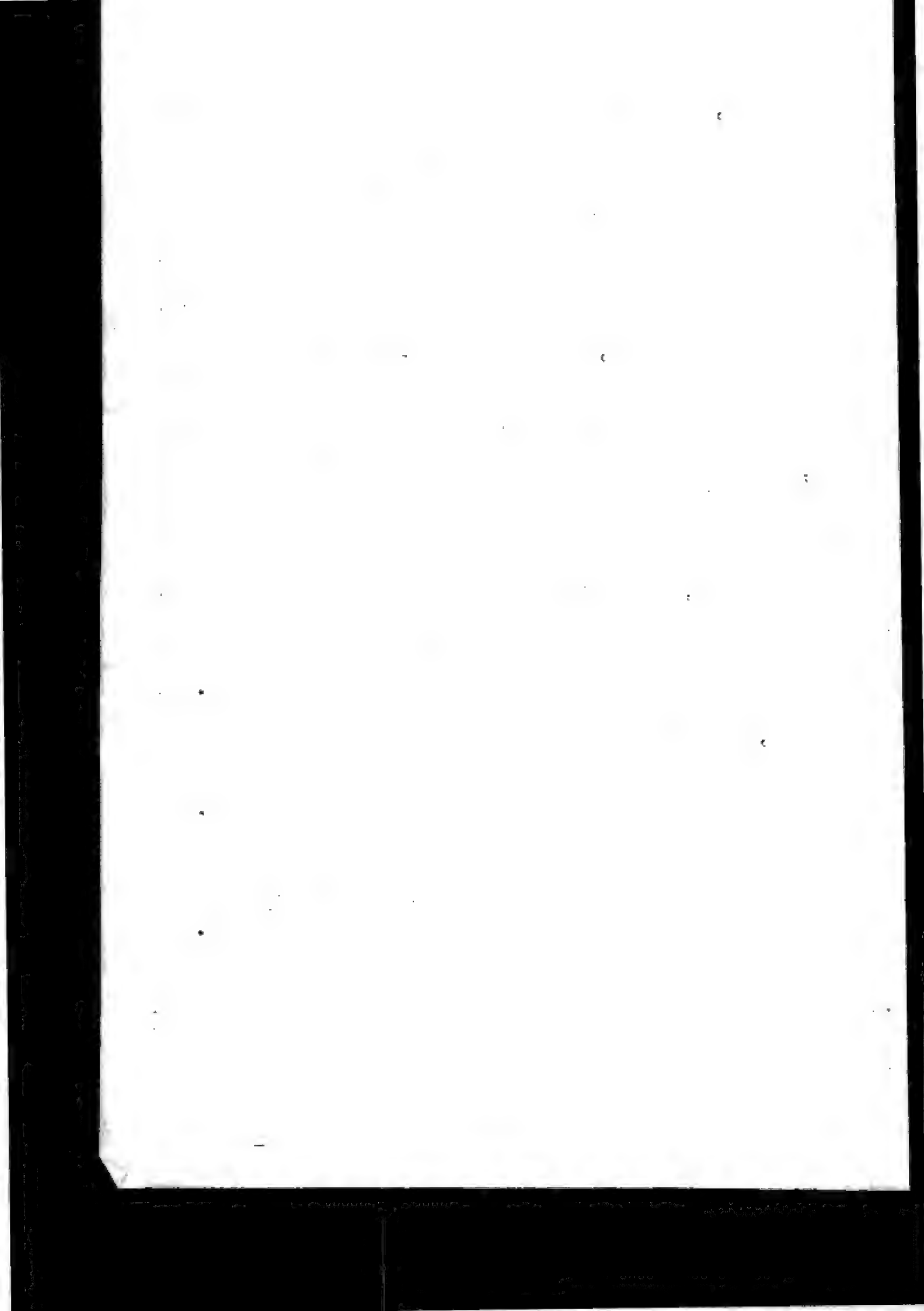
device to control pitch and roll of oil burning	Nov.70a
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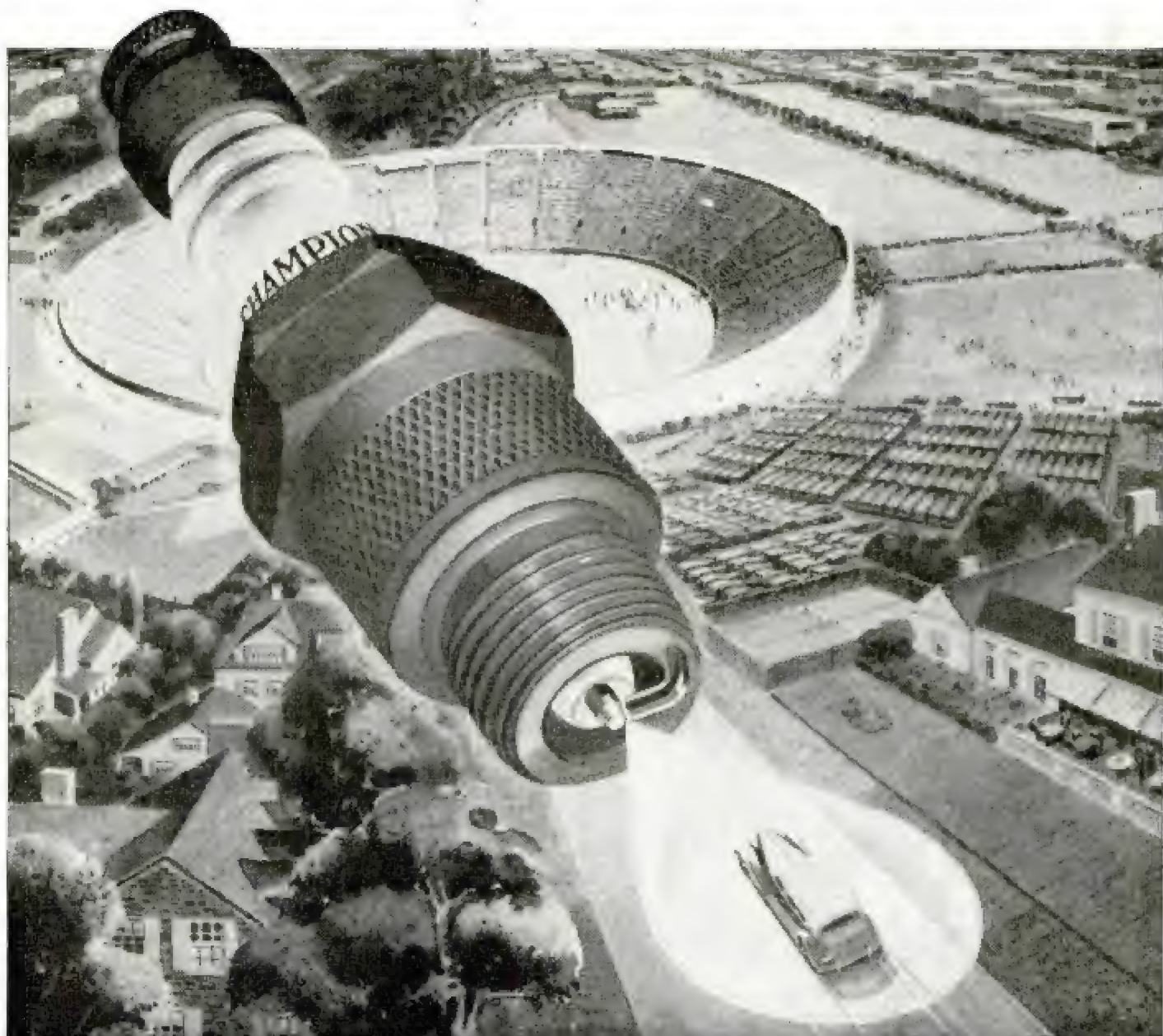
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SMOOTH ENGINE PERFORMANCE DEPENDS ON SPARK PLUGS

Smooth, powerful performance in an engine is like smooth, powerful performance in a football team. It is the result of perfect harmony and balance.

That's why smooth engine performance depends to an extraordinary degree on spark plugs—for smoothness can come only with perfect combustion in every cylinder.

Champions alone are permanently compression or gas tight due to their patented Sillment seal. Only gas tight spark plugs which are immune from overheating, pre-ignition and excessive burning of electrode wires, can possibly remain in their designated heat range, which is the secret of smooth, balanced engine performance.

That is why you should insist on Champions and install a complete new set when replacing spark plugs every 10,000 miles. This is a regular practice with millions of motorists. They know the cost of new Champions is quickly saved in lessened gas consumption—quicker starting—faster acceleration—and greater dependability.

YOU CAN DEPEND ON
CHAMPIONS
THE SPARK PLUG CHAMPIONS USE



CHECK AND CLEAN SPARK PLUGS WHEN YOU CHANGE OIL

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RIGID DRIVER
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If not displayed by dealer, mail \$1.00 with coupon, for "Yankee" Handyman, No. 33H, and one blade, postpaid. "Yankee" Tool Book, sent free.

Name

Address

(Continued from page 124A)

his field of vision was considerably restricted.

"Did you ever have a bad traffic accident?" he was asked.

Thinking back, he remembered he had. Several years ago, a truck had suddenly appeared—seemingly out of nowhere—and it was too late to stop. It was on the left side. The expert nodded in agreement. It often happens that otherwise good drivers will have a series of accidents and in each case the other vehicle will be found to have been coming from the same side. Tests then may show that the vision is restricted on that side and that the driver is partially blind in that eye, so far as moving objects are concerned—even though the same man may read eye charts perfectly and need no glasses. Quite often the trouble is due to some focal infection in the body.

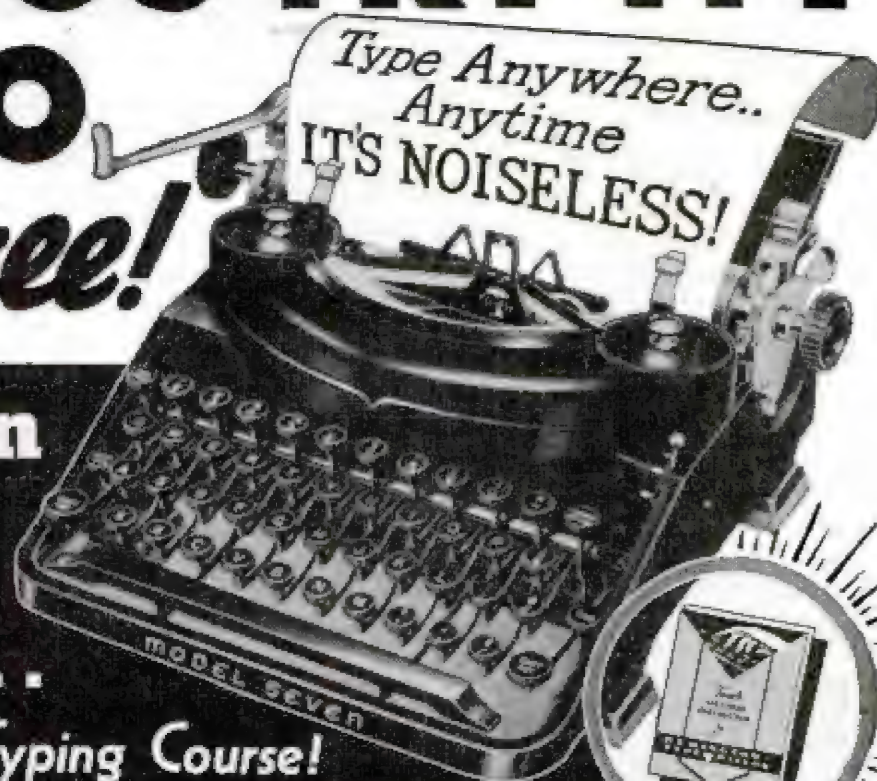
The expert suggested that our driver have his teeth and tonsils checked. When this was done, the dentist reported an abscessed tooth on the left side near the frontal sinus. Sometime our driver intends to go back for another test and see if his field of vision hasn't gone back to normal since the bad tooth was extracted. At any rate, he hasn't had an accident since. Maybe the reason is that he is always extra careful to turn his head and look especially well to the left before entering an intersection, just in case his blind spot isn't working.

Our good night driver believes that one of the best ways to play safe, next to the most important one of never driving so that he can't stop in the distance he can see ahead, is to take a thorough examination such as are given by many of the state traffic bureaus, and learn if he has any unsuspected weaknesses that may endanger him in night driving. In California, drivers who have repeated accidents or persistently violate signals are sent to a clinic for scientific examination and every day these examiners find people who didn't realize they needed glasses, although they were endangering their own lives and others every time they took the wheel. He isn't too proud to admit he isn't the world's best driver, and his modesty and caution will keep him on the road for years after some of his heavy-footed friends who call themselves "good drivers" have taken their last ride in the undertaker's hearse.

WILL YOU TRY IT? ..FOR 10 DAYS *free!*

Remington Noiseless Portable...

Including Simplified Typing Course!



Try This New Remington Noiseless For Ten Full Days

See how useful it is for *all* your family. Use it—test it. Then—and *then only*—decide if you want to keep it. If you don't, *return at our expense* and the entire trial doesn't cost you a penny. Imagine! 10 days trial *absolutely free!*

It pays to own a typewriter! Educators report 14% *higher school marks* for students who *typewrite!* Every parent should learn how a Remington can help children to get *better school ratings*. And, besides, how it will help the *parents themselves* in everyday activities... for business reports, memos, personal letters, applications, contest entries, etc.

By dealing with Remington Rand (world's largest manufacturers of portables) you're sure to get a *brand new model* with all the latest features of expensive office machines. Standard keyboard, full size carriage width, automatic ribbon reverse, composition keys, handset tabulator. But the *biggest* is "WHISPER-TYPING"—the new *noiseless* way to *type anywhere, anytime* without making a sound.

PAY 10¢ A DAY!

Yes, 10¢ a day is all it costs to own a new Remington Noiseless Portable, complete with Special Carrying Case and FREE Self Instructor Typing Course. Lowest terms ever offered. Now it's easy for everyone to afford a personal typewriter!

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Tell me how I can get a Remington Noiseless Portable for 10 Days Trial... *free!* Also send facts about Free Typing Course and 10c-a-Day Plan. *This is not an order.*

NAME.....

ADDRESS.....

TOWN.....STATE.....

The Wonders of a Lost Empire

(Continued from Coloroto Section)

of the New Empire. It is a round tower forty-three feet high and thirty-six feet in diameter. Narrow openings through the thick walls to a circle of windows near the top formed "lines of light" or lensless telescopes through which observers watched the heavenly bodies and thus were able to fix proper dates to be placed on their highly precise calendars.

An outstanding example of Maya architecture is the Palace of Acuitok Tutulaxui at Uxmal, one of the larger cities of the New Empire. A single temple contains a wall 720 feet long, its length intricately carved and it has been estimated that it would cost more than \$1,000,000 for expert labor equipped with the finest tools to reproduce this twenty-four-room temple



The new Supreme Court building in Washington, a modern architectural triumph—but the Mayas did almost as well centuries ago

today—and that's exclusive of materials. This palace stands atop three terraces, more than fifty feet above ground level and the lowest terrace covers five acres. The upper half of the facade on all four sides presents an intricate sculptured design composed of some 20,000 stones, many weighing more than twenty tons and all of them carved out of solid rock by hand.

How does this ancient structure compare with the most modern, the new Supreme Court building in Washington, for example? The Supreme Court building cost more than \$9,000,000 and three years were required to erect it. Both structures contain thousands of tons of solid masonry but the modern building has a structural

steel framework containing 5,000 tons of steel columns, beams and girders while the Maya temple is all stone.

The Washington structure contains 22,000 tons of marble valued at \$3,400,000, the two largest blocks weighing about fifty tons each. The building measures 385 by 304 feet, the central portion is four stories above a terrace on one side and three stories above a terrace on the opposite side, rising above adjacent wings which stand three stories above the terraces. The main floor is one story above the terraces.

Here is a splendid architectural achievement, representing most of what modern engineering and architectural science has learned through the ages. But this great structure seems unimportant, almost puny, when compared with the Maya edifice. The floors of the modern building are of stone about one and one-half inches thick. The floor of the Maya temple is from two to three feet thick and hewn out of solid rock. The individual marble blocks on the exterior of the Supreme Court building weigh about 800 pounds each and average four feet by one foot by ten inches. The stone blocks of the Maya building are from four to ten feet high and weigh from half a ton to more than twenty tons each.

The major principle of Maya architecture was a design of simple masses without porticos or embellishments except for elaborate carvings. These early Americans had an inexhaustible supply of building material under their feet, they evolved a social system which provided the time and the man power necessary to cut and carve this material virtually with their bare hands, and they possessed the infinite patience and determination essential to the accomplishment of the tasks they set themselves under the conditions they faced.

Comparing the achievements of the Mayas with our own accomplishments is grossly unfair to the Mayas because we have the knowledge of the ages behind us while the Mayas had only their own experiences to guide them. Thus the construction of an Empire State building with the aid of modern building materials, machinery, power and transportation facilities is possibly much less an achievement

(Continued to page 130A)

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NO MATTER HOW LONG YOU OWN
YOUR CAR...NO MATTER HOW FAR
YOU DRIVE IT...THIS BATTERY IS
GUARANTEED NOT TO COST YOU A
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Goodrich KATHANODE *Electro-Pak*
GUARANTEED AS LONG AS YOU OWN YOUR CAR

The Wonders of a Lost Empire

(Continued from page 128A)

than the erection of a Maya temple of far less size and complexity, but built entirely without metal tools, structural steel, cement or any form of mechanical power.

To find a condition in our own history comparable to that under which the Mayas lived, we would have to go back to early Neolithic times when our own ancestors' knowledge and utensils were similarly restricted. On such a basis of comparison, the Mayas stand head and shoulders above our own forefathers in cultural brilliance. In fact, when we unjustly compare their accomplishments with our own, our ego should be considerably deflated.

One thousand years ago these early Americans boasted achievements which we today, with the knowledge of the centuries behind us, could scarcely duplicate if we were forced to labor under the same limitations and restrictions they faced. When their abstract intellectual achievements are added to their material accomplishments, the Mayas may well be acclaimed the most cultured and brilliant aboriginal people who ever inhabited this or any other continent.

"Water Smellers" Detect Odors in Public Drinking Supply

Classes in "water smelling" are being taught at several colleges to train experts for testing public water supplies for tastes and odors. A few decades ago it was thought necessary only to distribute usable, safe water. Then clear, brilliant water was demanded and the waterworks began clarifying it with alum and other treatments. Chlorine is added to purify the supply, and some communities soften water to cut depreciation in pipes. Now the palatability of water has become important, and tests are made by college-trained specialists using entirely the sense of smell. Objectionable tastes and odors are removed from water by activated carbon, a substance many times more powerful as a deodorant than charcoal.

☛Inquiries as to makers of articles described in Popular Mechanics will be answered by our Bureau of Information upon receipt of return postage.

Radio Music of the Future

(Continued from page 693)

beside the bass fiddle. Without the mike the beat of the instrument is lost entirely in the other music. A particular way of beating on the rim of the snare drum with regular wooden sticks produces, in the loudspeaker, the sound of hammers clanging on steel.

With the coming of microphone music, it will be possible to create new tone colors in almost unlimited number. Not only can tones be amplified on the mixing panel of the control room, but they also can be changed. Desired elements of the tonal quality may be played up or down at will. Scott is already experimenting with such tone changes. One effect he expects to achieve is the creation of a pigmy band in sound. He will depict musically the dream of a child who goes to the pigmy land and joins a band. On the mixing panel Scott can extract from the full, open tone of the trumpet just those tiny, squeaky sounds that best suggest the instrument that a pigmy might play.

Scott also is experimenting with the piano, his own instrument. The tone familiar to our ears is that made by striking the keys, which cause little hammers to strike the strings. The attack of the hammers on the strings nearly always is audible in piano music, giving it a percussive effect not inherent in the tone itself. Divorced of the attack sound a piano tone is ethereal, disembodied, with a sense of great space about it. Pianists sometimes achieve it by skillful manipulation of the middle pedal. By placing a "dead" microphone beside the piano and then turning it on only after the keys have been struck, Scott is able to catch the ghost-like effect, adding still another tone color to music.

Million-Mile Blanket Around Sun Seen in Stratosphere Photo

Surrounding the sun is a globular blanket a million miles thick, photographed for the first time from a sub-stratosphere airplane during the solar eclipse last June 8. Astronomers who studied the pictures taken from a 25,000-foot altitude said they "clearly show the corona as a globular shell surrounding the sun with a depth much greater than a solar diameter."

Maja Albert W.
Stevens

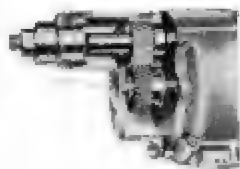
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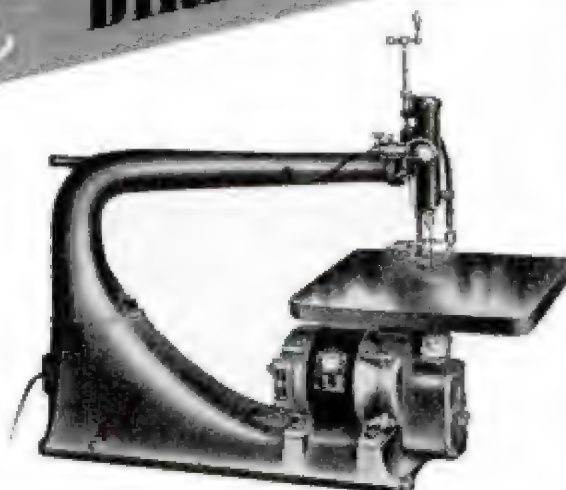
up to 40% of your motor's power
formerly wasted by belts!



No More Belts..... No More Pulleys..... No More Slippage
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DRIVER
MJ917 JIG SAW
\$48.50

Complete with Motor (110 v. 60
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The MJ917 has a throat capacity of 24", a heavy 11" x 14" tilting table, splash oiling, removable arm for sabre sawing, fully adjustable blade roller guide and under-table blade support. An automatic blower keeps the cutting area clear of sawdust at all times.

**MJ744—ONE SPEED DIRECT DRIVE
MODEL** (otherwise similar to MJ917)
\$38.50 as shown, less lamp and blade.

DIRECT DRIVE

On These Two New Driver Tools!

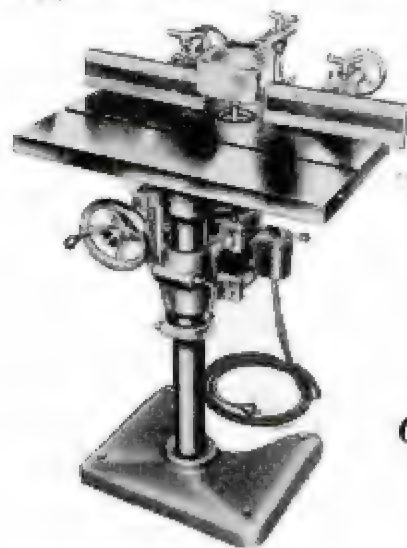
\$980 SHAPER (left) \$125.00, including
¾ H. P. Motor (complete as shown).
990 TILTING ARBOR SAW (right)
\$75.30 complete as shown, less motor.

Ask your Driver dealer for a copy of
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news in power tool history. New tools!
New engineering developments! Full
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DIRECT MOTOR DRIVE—No belts, no
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Handle any type of work without a stop!

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almost impossible by hand and giving
your work a truly professional appear-
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motor, arbor control with 6" spindle
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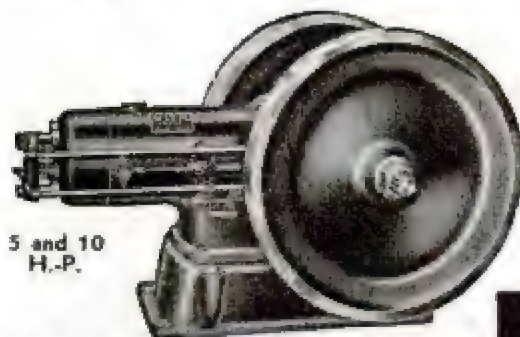
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UNBELIEVABLE ECONOMY

Produce **ELECTRIC LIGHT & POWER**
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Simple in design and construction, the WITTE is the most important development in the small engine field. Thoroughly modern in every respect, incorporates every worth-while advance in Diesel Engine design. The 1600 watt Dieselectric Plants are small, compact and radiator cooled. Installation is simple—upkeep low—unusual flexibility for power applications. 110 volt A.C. and D.C. plants for direct lighting. 32 volt plants for low cost battery charging.

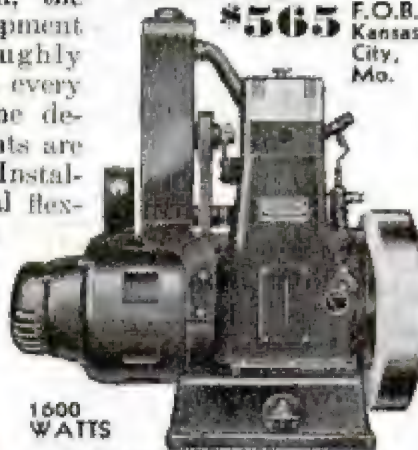


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BURN YOUR NAME ON TOOLS

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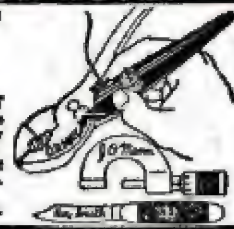
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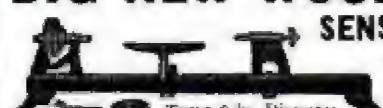
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Turns 8 in. Diameter
36 in. between Centers
Headstock, 3 step cone pulley for V-belt. Extra long reservoir oiler bearings. Spur center and 4 inch face plate screw onto spindle. Tailstock spindle has screw movement of 1 1/2 in. Tool rest 8 in. long. Priced amazingly low. Accessories include 3 step cone motor pulley, V-belt, and set of 4 turning chisels. Shipping weight 30 lbs. Send now for new FREE catalog, low prices. Not sold through agents.

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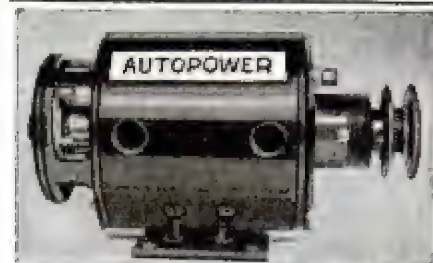
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WANT a new business profession of your own, with all the trade you can attend to? Then become a foot correctionist, and

in a few weeks earn big income in service fees,—not medical nor chiropody—easy terms for home training, no further capital needed, no goods to buy, no agency. Established 1894. Address **Stephenson Laboratory, 1 Back Bay, Boston, Mass.**



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Magic Crystals of Growth

(Continued from page 683)

glass spears, like a forest of toothpicks. Each baby plant sprouts from a single oat seed clasped in a tiny glass tube. Looking closely, you see that each seedling bends slightly at a point where a tiny lump is attached to its stem.

"That's a hormone 'poultice'," explains Dr. Went. "A minute slab of agar containing the powerful growth hormone is attached to the stem. Immediately the plant cells begin to stretch and grow. Soon the treated side has outgrown the other, making the seedling lean over."

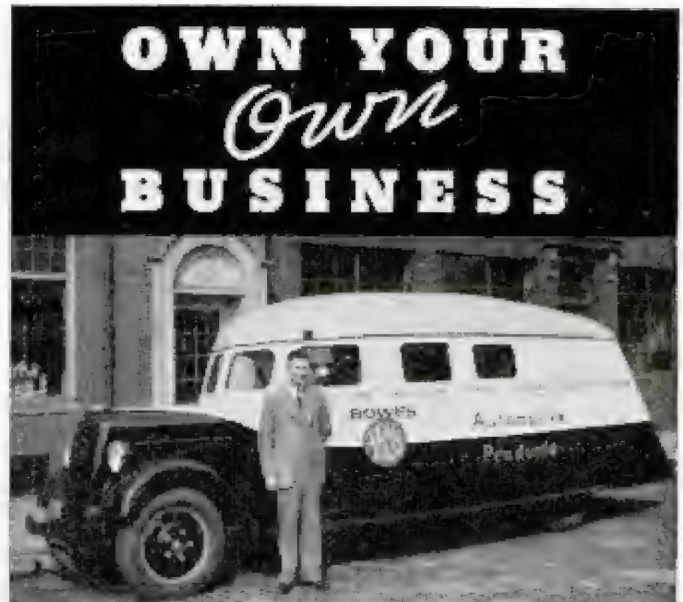
Professor Walter F. Loewing of the University of Iowa applied a hormone poultice to a poinsettia stem and overnight the plant grew so lopsided it was on a forty-five degree angle. Within two days, however, the plant's natural secretions restored the balance and the growing tip again was pointed straight up—but the kink remained. In another experiment, repeated applications caused a poinsettia stem to turn a complete loop.

Experimenters in Dr. Went's laboratory get minute quantities of true hormone to work with by cutting the tops of young shoots and blotting up their secretions with a tiny block of agar, much as a farmer taps a tree for maple sugar. This hormone-soaked "poultice" then may be used to treat other plants. In the present series of experiments, more than 1,000,000 delicate surgical operations have been performed on tiny oat sprouts, some of them no more than a quarter inch long.

Strength of the hormone is gauged by attaching the poultice to an oat sprout and measuring the angle of the bend it produces. The stronger the hormone, the sharper the kink.

Dr. Went finds that through a simple action, this wonder-working chemical substance governs all movements of a plant as a gyroscope stabilizes an ocean liner. Auxin, generated at the top of a growing plant, flows downward and makes the roots grow. It also keeps the growing tip headed upward, by evenly distributing itself throughout the entire stem.

Bend the stem, and you upset nature's chemical balance. Gravity automatically starts auxin flowing to the lowest part of the bend, where it collects, making that

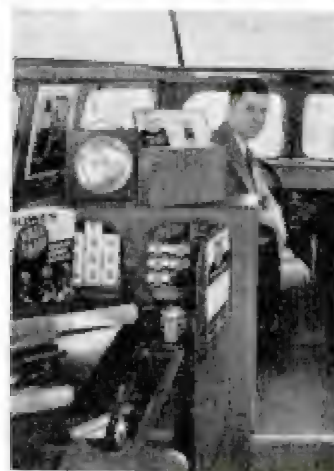


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If you're one of those men maybe Robert M. Bowes has an idea that will interest you.



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The Bowes "Seal-Fast" Corporation can use ten more distributors in various parts of the country. Bowes distributors are in business for themselves with the famous line of Bowes "Seal-Fast" products. This line includes the nationally advertised Tire Repair System, spark plugs, fan belts, battery cables and other materials which every dealer sells and every motorist needs.

Your jobbing establishment is a handsome, modern trailer. Your territory would contain at least

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Your territory is protected. Your profits are protected. The profits of your dealers are protected. The investment is moderate and you can turn it over six to eight times a year.

Men who can't earn \$3,000 per year on our deal are not wanted. Bowes distributors under this profitable plan are earning two or three times that amount—and it's not hard to do.

Write us at once. Tell us your experience and in what section of the country you would like to work. We'll send you a folder describing our entire line and proposition.

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This is no "catch" statement, no idle claim. It is *fact*—based on the experience of the past ten years. Would you like to be one of the 68%? Fine—then let's get down to brass tacks.

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You have often heard men say—"It's the breaks that count." *It is*—but did you ever stop to think how many successful men *made their own breaks*? For example: Joe was a salesman, no better, no worse than the others. Joe's now a sales *manager* in the same company. A *little* thing got Joe that job. His sales reports were clearer, more easily read and better than any other man sent in. They were *typed*. A little thing? *Sure!*—But it was just that little thing that made Joe stand out from the other good men in the territory. *And Joe got the job!*

That isn't a rare case. You can multiply Joe's story by hundreds. You probably know of a man yourself who had the same experience. It's happening every day, in every kind of business. For the world wants men who think straight, and *write* the same way.

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Like most of us you're probably "broke from one pay day to the next." But think of this, mister—A Royal Portable will cost you only *a few pennies a day*. Just *a few pennies a day for a raise*. A few pennies a day you'll never miss—that you'd spend anyway for something not half as important. *Think it over*. And in the meantime get yourself started on the way up by getting the new book, "Your 14% Better Chance for Success." And let us tell you about the special offer Royal is making on its new Portable to help men like you own one without wrecking your budget. Send the coupon.

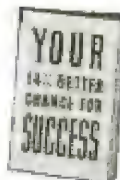
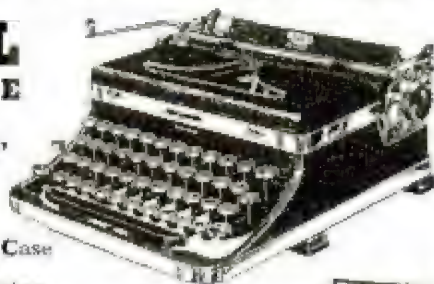
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part of the plant grow faster. Soon the faster-growing portion overtakes the other side of the stem, tipping it until the balance is restored and it again points straight up.

An equally simple explanation shows why plants reach toward the light. Light destroys auxin. Consequently the dark side of a plant grows faster than the light side, thus turning the plant always toward the light.

This sensitiveness to light is the reason Dr. Went has to work in the dark in his laboratory. If he were to strike a match, the flare of white light would attract all the thousands of baby seedlings. Within one second, they would be affected enough to make them curve and spoil the experiment. But the dim orange light does not attract them enough to interfere. For a similar reason, delicately adjusted thermostats keep this heat-insulated room always within a small fraction of a degree of the same temperature, for weeks at a time while the delicate oat sprouts are undergoing their strange transformations.

So limitless are the possibilities opened up by the growth hormone that Dr. Went refuses to guess at its applications. Already, however, Dr. Felix Gustafson has applied auxin to the pistils of flowers and caused them to bear fruit without being fertilized. The product is free from seeds, and seedless tomatoes thus can be listed among the first tangible products of hormone wizardry.

Will the mysterious hormone enable scientists to produce fast-growing vegetables and give us summer fruits and flowers the year around? Will rare or exotic plants, grafted onto sturdy roots of common species, grow marvelously under the stimulus of synthetic hormones?

Farmers find many of the powerful commercial fertilizers far better than farmyard manure, but some mysterious principle seems to be lacking. By adding to these synthetic fertilizers the right kind of artificial hormone, scientists may produce the perfect plant food, "tailored" to fit any soil in any climate.

A single ounce of auxin could produce enough growth to span the earth—you could create perhaps 10,000,000,000 new roots. It is not hard to imagine a farmer buying a tiny vial that will enable him to

(Continued to page 136A)

GIRLS DESPISED HIS SKINNY, PIMPLY LOOKS

but now he's gained
21 POUNDS

new health and popularity



"At parties I felt like a back number, I was so skinny and my face was so broken out with pimples that none of the girls ever noticed me. On the advice of a friend I started taking Ironized Yeast. In 12 weeks I gained 21 pounds and my face began to clear up and take on a healthy color. I'm strong as an ox now and so popular that the fellows call me a 'Ladies' Man'."

—Roy Rigby, De Kalb, Ill.



Roy Rigby

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And although this new scientific formula, Ironized Yeast, was perfected at the cost of thousands of dollars, it comes to you in pleasant little tablets which cost you only a few cents a day!

Why it builds up quick

Scientists have discovered that hosts of people are thin and run-down simply because they do not get enough yeast vitamins (Vitamin B) and iron in their daily food. One of the richest sources of health-building Vitamin B is the special yeast used in making English ale.

Now by a new and costly process, perfected after long research, the vitamins from this imported English ale yeast are concentrated to 7 times their strength in ordinary yeast! This 7-power vitamin concentrate is then combined with three kinds of strength-building iron (organic, inorganic and hemoglobin iron). Pasteurized English ale yeast is then added. Finally, for your protection and benefit,

every batch of Ironized Yeast is tested and retested biologically, to insure its full vitamin strength.

The result is these new easy-to-take little Ironized Yeast tablets which have helped thousands of the skinniest, scrawniest people quickly to gain normally attractive flesh and peppy health.

Make money-back test

If, with the very first package of Ironized Yeast, you don't begin to eat better and to get more benefit from your food—if you don't feel better, with more strength, pep and energy—if you are not convinced that Ironized Yeast will give you the pounds you need—your money will be promptly refunded. So get Ironized Yeast tablets from your druggist today.

Only be sure you get the original Ironized Yeast. There are many cheaper "Iron and Yeast" tablets on which the druggist may make more money—but you lose. Insist on genuine Ironized Yeast, with "IY" on each tablet.

Special FREE offer!

To start thousands building up their health right away, we make this absolutely FREE offer. Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body." Remember, results with the very first package—or money refunded. At all druggists, Ironized Yeast Co., Inc., Dept. 5511, Atlanta, Ga.

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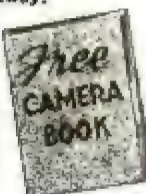


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(Continued from page 134A)

start nursery plants sprouting weeks before winter is over, thus beating the seasons. In fact, right now a number of commercial companies are offering root stimulating compounds for which they claim magical properties—but the active principle in these substances is the synthetic hormone, indole acetic or indole butyric acid, which can be bought from chemical supply houses for about three dollars a gram. One gram makes five quarts of solution, in which cuttings are soaked overnight before planting. A quart will treat 600 to 2,000 cuttings, and within a couple of weeks the hormone causes roots to sprout and growth begins.

By aiding sick trees to put forth healthy new roots, auxin has the power to promote astonishing recoveries and may greatly aid tree surgeons. Many trees formerly could be propagated only by grafting the cuttings onto roots of another kind. Thanks to auxin, this is no longer necessary. The young plant, moreover, has exactly the same characteristics as the parent tree.

Now forest service experts are hoping its magic touch may quickly repair the ravages of fire. Recent experiments at the California Institute of Technology show that cuttings of mountain lilac, a natural cover for western hills, sprout readily if treated with auxin. While C.C.C. men bring a big forest fire under control, nursery men can clip thousands of twigs from lilac bushes and soak their bases in auxin. Two weeks later these can be set in the ground, and within another week they have rooted and a new forest is growing lustily amid the ashes of the old.

201017

Indoor Blasts Smash Marble But Break No Windows

Powerful pavement breakers could not make a dent in the big blocks of marble a San Francisco company had bought to crush for a composition material. One hammer after another, each bigger than the last, was tried without avail. Finally explosive engineers were called in. They drilled holes in the marble blocks, inserted extremely small charges of explosive gelatin, and fired it electrically. The marble was blasted to pieces, yet factory windows a few feet away were not damaged.

Science Service
8/21/27



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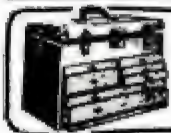
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School Days for Baby Race Horses

(Continued from page 701)

The lead pony is one of the most important horses on the training farm and is a calm sedate animal just the opposite of the racing type. An ex-race horse never makes a good lead pony. It takes about a year to teach a lead pony its work and after that the lead pony seems to understand and enjoy the schooling, working just as hard as the trainer to teach the pupil what to do. One lead pony now retired at San Luis Rey worked as an instructor for thirty years and crossed the Atlantic four times during his career to teach manners to young colts.

First on the program is to teach the young horses to walk quietly around the school track in company with the lead pony. Riding the pony, the trainer leads the colt at the end of a short rope. For the first few days the colt may try to run away, dodge under the pony's neck, and do everything else he can to break away. A good lead pony is able to detect the colt's intention before he starts and calmly move his head to stop him.

Gradually the lead rope is shortened until the colt learns to walk, run, and stand with his head close to the lead pony's saddle. The next step is to fasten gently a surcingle and pommel pad on the horse and lead him around for an hour a day until he is completely accustomed to this novelty. In the box stall the colt is introduced to a rubber-covered bit that goes between his teeth and that snaps onto the halter he wears.

The next course is to teach the colt to carry weight and for this a canvas pad with pockets in it is placed on his back over the pommel pad. Heavy metal weights are slipped into the open pockets and this load is gradually increased until the colt is carrying fifty pounds. After that a light racing saddle, bridle, and complete equipment except stirrups are substituted for the weighted pad and the colt carries this "tack" every day for his full routine of walking and running with the lead pony.

By this time the training has become more intense. A jockey trainer is assigned to each five colts in the class and from now until the class graduates the jockey pets and works with the horses in his charge.

(Continued to page 140A)

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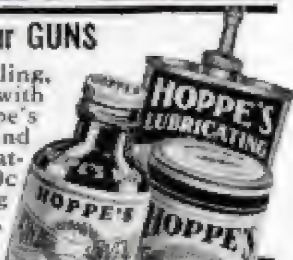


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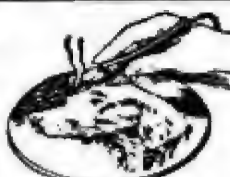
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(Continued from page 138A)

The colts grow accustomed to their jockey and rarely object when the time comes for him to jump up on their backs.

Part of the equipment at the school is a typical race-track starting gate, consisting of a high white barricade with separate open stalls through which a horse may walk. Every day the trainer and the lead pony lead the colts, one by one, up to the gate and through it. By the time they graduate they are able to stand quietly in the stalls without growing alarmed.

One day, when his colt is snubbed up close to the lead pony, the jockey jumps up into the saddle. After a few rides trailing the lead pony and trainer, the jockey places stirrups on his saddle and now the colt is ready to be turned loose. Out on the track the trainer unfastens the lead rope and gradually the jockey begins to steer the colt around with his reins.

The colt is now a full-fledged saddle horse but he still has a long way to go before he qualifies as a racer. Every day his jockey-rider takes him out on the track in company with another student horse to get him used to running in company. Within sixty days the horses are galloping around the track in sets of six or eight and are going through a typical program of saddling, walking, and standing in the starting gate.

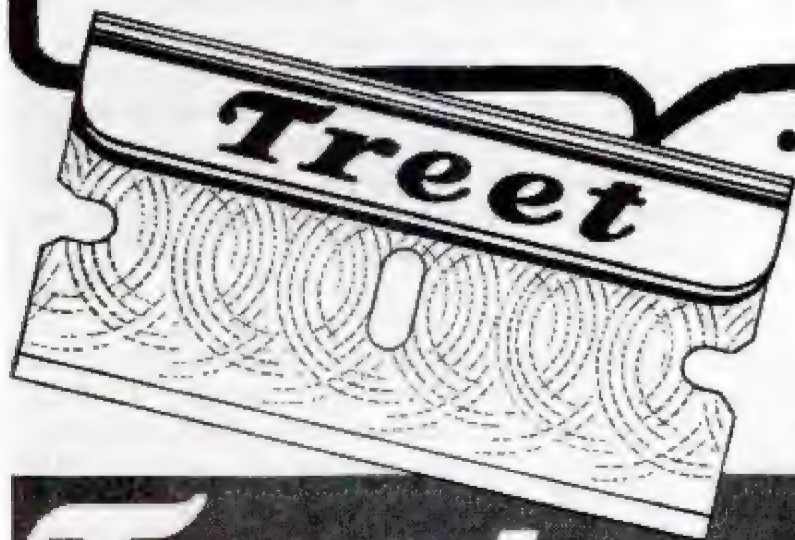
"The long, smooth stride of a fast horse is natural to the thoroughbred but not all of the colts are able to find this pace by themselves," Cooper says. "When a horse is running well his head is stretched out in front and his whole body takes on a sort of streamline appearance. Some of the colts fall into the rhythm of this high-speed stride at once but others are inclined to run at a bouncing gallop.

"The way we teach a frisky colt to run properly is to take him out on the track with an old race horse and run them side by side. Gradually the colt begins to adapt himself to the long stride of the older horse. Once the colt learns the rhythm of the fast gallop he never forgets it.

"Right about this time Tom McCook, the trainer, starts to study each individual student horse to pick out any minor fault that may be holding back his speed. It may be that paring the hoofs differently will make a slight correction in gait. One horse may

(Continued to page 142A)

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(Continued from page 140A)

develop a habit known as climbing, in which his front feet seem to finish their strokes in the air instead of at the instant they touch the ground. The horse will be pushing ahead with his back feet but will not be pulling his body with his front feet. The way we correct this is to tie a wide sheepskin band across the colt's nose so that he has to hold his head lower in order to see the ground. Then he automatically places his feet properly. After a few runs with the band across his nose the horse will always run true."

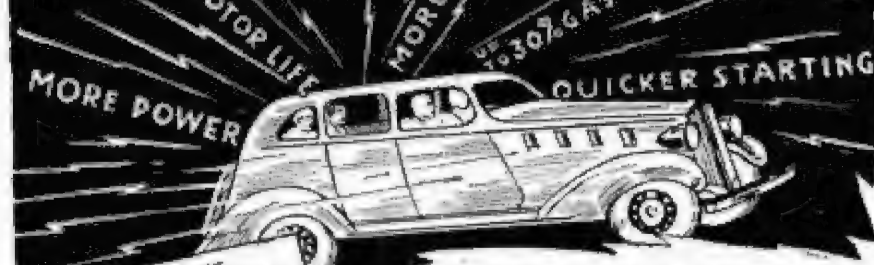
The last thing on the program is real racing. Here again the horses start in small groups of three or four. Lined up in the starting gate, the horses get the full routine of the start of a real race, with the starting bell, the call of the starter, and yells of encouragement helping them to break out into a fast start. This is always an exciting maneuver to the colts and not all of them run straight the first few times. The lead pony or a trained race horse always takes part in the starting and the practice racing to help show the colts what to do.

The rail position is the shortest route around a race track and as soon as he breaks from the gate a good race horse starts to move over and fight for that position. This is one of the big lessons that he learned in his student days. The track at the rancho has a hard, firm path right alongside the rail, but a few feet away the ground is soft and it is kept softer as the distance from the rail increases. Horses like firm ground under their feet and they learn rapidly that they can gallop best on the path of hard ground right along the white fence. From then on they move over instinctively at the start of a race.

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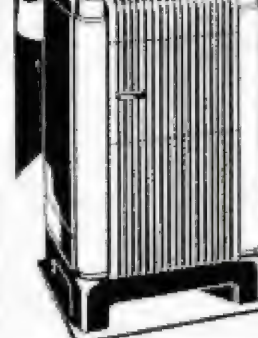
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How to Care for Your Firearms

(Continued from page 735)

vigorous scrubbing is needed to get at the metal fouling.

One nationally known ballistics and shotgun authority points out that the metal fouling in a shotgun barrel is made by packed charge of lead shot moving at a far greater velocity and pressure against a hot barrel than you can exert with a soft brass brush. So there is no danger of damaging the barrel.

The next step is to use cloth patches. You may use two kinds, woolen and cotton. Clean with these. When your last patch comes out white you can be pretty sure that the gun barrel is clean. Just to



Proper care of the gun calls for the use of light oil on the inner parts

make sure, run a final clean patch moistened with nitro solvent through the barrels and leave the gun for a day or two with this coating of nitro solvent and then go after the barrels again to make sure that they are clean. And don't forget; clean your shotgun from the breech, not the muzzle.

You can scrub the smooth barrel of a shotgun back and forth, but you can't use this method on a rifle because damage may be done to the rifling in the barrel by forcing a brush or patch against the rifling. The point to remember is to allow the cleaning rod with the brush or cleaning patch to follow the rifling and take it easy when you work the rod through the barrel.

Always clean your rifle from the breech, if you can. The idea is to avoid striking or banging the muzzle of your gun with a cleaning rod, because you might make a slight burr there and thus impair the accuracy of the rifle. If you can't clean from the breech you should be extra careful with rod and brush when you insert them into the barrel.

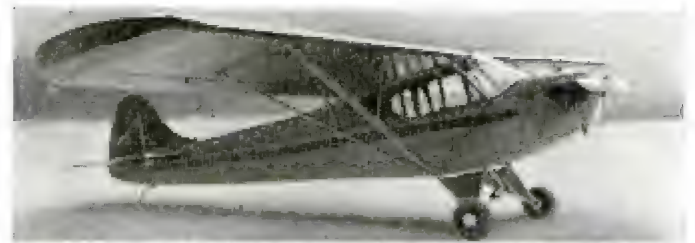
Always start rifle cleaning, no matter if it is a .22 caliber or a big-game rifle taking shells with 180-grain bullets, by pouring a small amount of nitro solvent through the barrels. Then run the soft wire brush through the barrel. The latter takes care of both metal fouling and residue as it follows the rifling in the barrel and presses against the steel. If you have been doing a lot of shooting don't stop with just one trip of the brush through the barrels. Run it through slowly several times, never forcing the cleaner against the rifling but always allowing it to turn with it. Use of this brush will remove the metal fouling. You can get rods which are made so they permit the cleaning patch to turn with the rifling. One is made of metal and is in three sections. The tip of this rod is swiveled so it moves easily through the rifling. It costs about one dollar. You also can get a small, one-piece wire cleaning rod with bristles on the end for ten cents. There is no excuse for not keeping rifles clean. The cleaning tools cost little.

The combination of a cleaning rod, a brush, plenty of cloth cleaning patches, nitro solvent and work will clean a rifle. If the barrel should become leaded it is best to consult a good gunsmith or return it to the factory. That's hardly a job for the amateur.

After cleaning the barrels, and wiping the outside of the gun with an oiled rag, better put a few drops of oil in the locks, around the firing pins and around the trigger. For the wood parts a dab of raw linseed oil rubbed in is recommended.

In cleaning revolvers the owner again should watch how he operates the cleaning rod. The brush and the patches must follow the rifling. We find a brass cleaning rod with a large wooden handle and a swiveled end is most satisfactory. After you have cleaned the revolver and the rifle be sure and leave a coating of oil in the

(Continued to page 146A)



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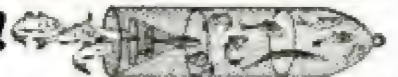
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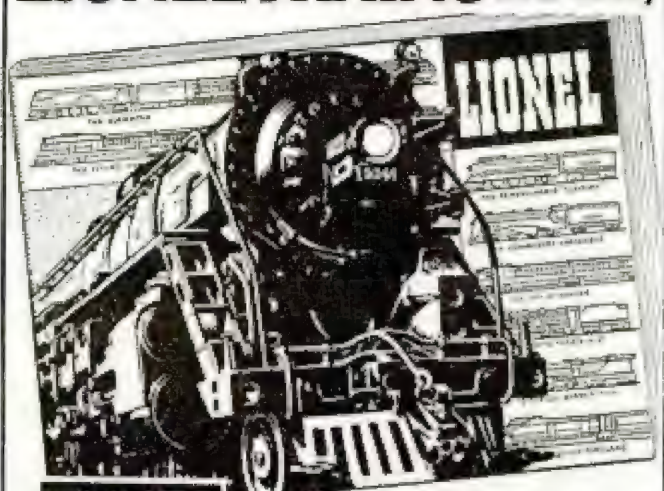
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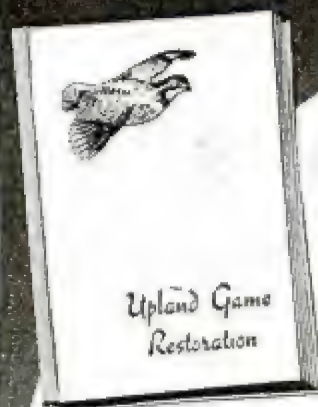
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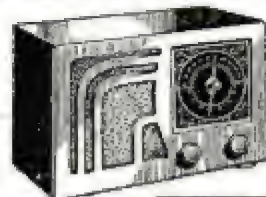
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How to Care for Your Firearms

(Continued from page 144A)

barrel. Then if the gun is to be left any length of time better put a light coating of grease in the barrel. This must be swabbed out before you shoot it again.

In addition to rifles, shotguns, and revolvers the sportsman's leather boots must be "doctored" with oil almost as carefully as a gun barrel if you want to keep them soft, pliant, and weatherproof. Here are a few suggestions on treating your leather boots so they will give you the most comfort in wet or snowy weather. The secret of soft leather boots that will last a long time is not to allow the leather to lose its oil base. Leather has pores. If you keep these pores well filled with some kind of oil or grease the leather keeps soft and resists weather. If your boots should get very wet don't allow them to dry too rapidly and don't put them too close to a hot fire. Stuff the boots full of shredded paper and let them dry out slowly and then oil them again.

You can buy many good leather waterproofing and dressing preparations on the market. For the sportsman desiring to concoct his own at home one of the simplest mixtures can be made by mixing equal parts of harness oil, or neat's-foot oil, and real beeswax. Use a large container for heating the two because it is best to put the bottom of the well-dried boot into the dope and rub it into the leather. You can use your hands to rub in the dope or take an old toothbrush for this purpose. When you have treated each boot put them away in a warm dry place. Pour the waterproof dope in a mason jar and keep it until you need it again.

A second recipe calls for equal parts of vaseline (yellow), neat's-foot oil and beeswax. Melt them together and apply as above. Some Norwegian guides will use nothing but a combination of cod-liver oil and beeswax. This recipe sounds like a good one.

❖ Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.

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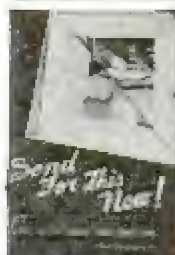
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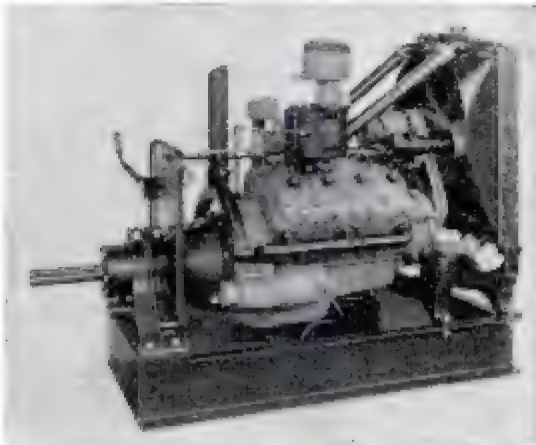
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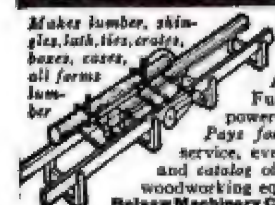
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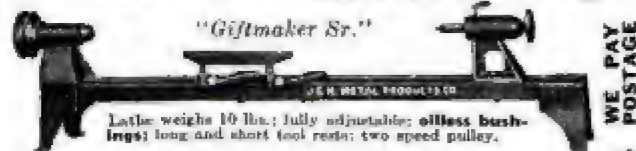


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How to Build a Radio Balance

(Continued from page 740)

placement. These sliding rear covers may be of Masonite, or similar material instead of plywood, if desired.

Both front panels are now drilled for mounting the meters and controls. The diameters of the meter holes will, of course, depend on the type of meters used. Small wood blocks screwed to the inside of the front panels and 14-in. strips from G to G, hold the dry batteries firmly in position, as will be noted in the rear-view photos of the completed instruments shown in Part I.

Soft leather washers should be glued and tacked against the frame around the 1/4-in. brass bolts which mount the adjust-



able oscillator unit on the carrying handles which are detailed in Fig. 8. All mounting bolts are held with brass washers and hex nuts on the outer sides of the handles, the heads of the bolts being flush with the surface on the inside of the cases. Since the instrument is to be used out of doors, all exposed parts are given a coat of mahogany stain and one coat of well thinned spar varnish. This is rubbed down and two coats of regular spar varnish applied.

When the tube strips have been wired, as shown in Figs. 1 and 2, they are ready for mounting on the wood blocks (F) inside the loop frames. Referring to Fig. 2, it will be noted that two .05 mfd. mica fixed condensers are specified; these condensers should be .0005 mfd. instead of .05 mfd. In wiring the tube strip terminals to the batteries, meters and various controls, use No. 20, black insulation, stranded push-back wire for the negative A fila-

(Continued to page 152A)

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This November issue is full of articles for professional and business men, for engineers and students, for scientists and skilled workers. Just read that partial list of contents and buy your copy today.

What place, in automotive design, has the supercharger? Can the electric eye make machines more accurate—and safer, too? Is mechanical progress impeded? Mechanically minded men will find these and many other questions answered in Science Digest for November. Science Digest reviews the whole world of science clearly, concisely, entertainingly. Each month more people find in Science Digest information of use

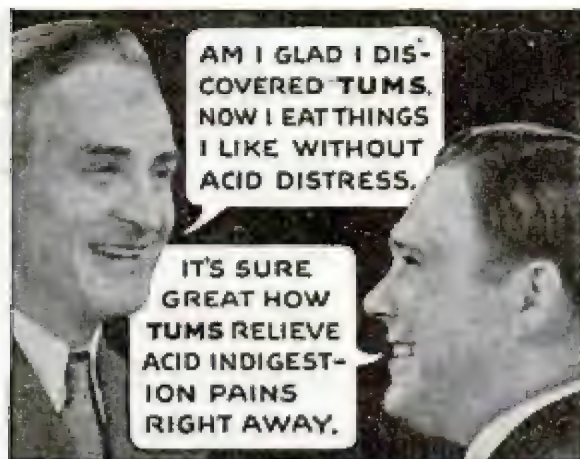
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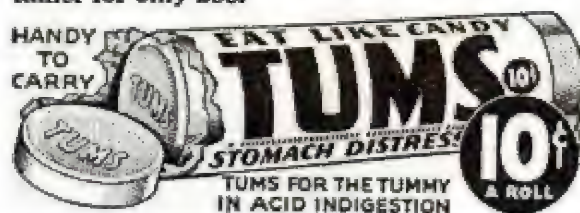


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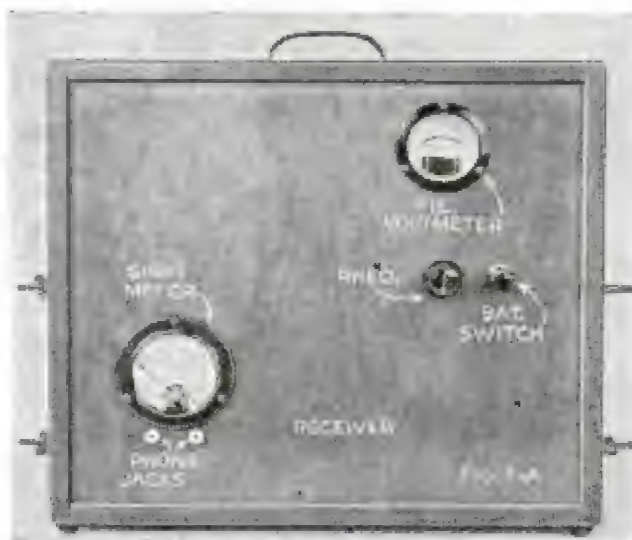
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Money-back guarantee. Free catalog on request.

(Continued from page 150A)

ment connections and white for positive A. The same kind of wire, with red insulation, can be used for all positive B leads and other meter and control leads. Particular attention should be given to R.F. choke No. 2 which is mounted on a long wood screw which acts as a pivot for the choke which is connected with flexible leads so that it may be turned for maximum sensitivity in the final adjustments. A complete list of all the original materials used, together with tuning, balancing, depth gauge measurements and operating instructions, can be obtained from Popular Mechanics radio department, without charge. The blueprint number is R-243.



After checking all wiring carefully, insert the tubes and connect the batteries. Turn on the filament switch of the receiver and adjust the rheostat so that the voltmeter shows 2 volts. Then adjust the 100-ohm potentiometer across the sight meter until it reads about 3/4 full scale. Insert head phones and listen; if any squeals or rasping sounds are heard, they can be eliminated by random adjustments of variable condensers C₂ or C₃, or by slightly rotating choke coil No. 2. If squeals cannot be eliminated by such adjustments, it may be necessary to bridge a fixed condenser across the 100,000-ohm resistor of the fourth tube from the left. The necessary capacity may be anywhere from .001 to .006 mfd. to eliminate oscillation. Now turn off receiver and switch on the oscillator; make sure the filament rheostat properly controls the voltage on the two type-31 tubes. Photo Fig. 7-B shows an all-angle level on receiver, for estimating depth of ore vein or pipe line.

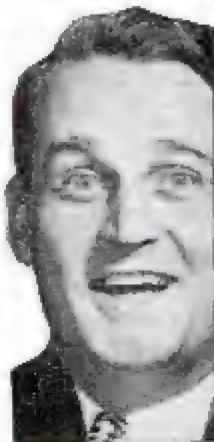
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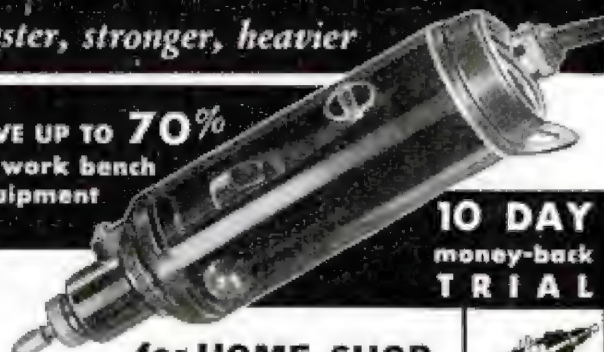
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The Eye That Never Sleeps

(Continued from page 725)

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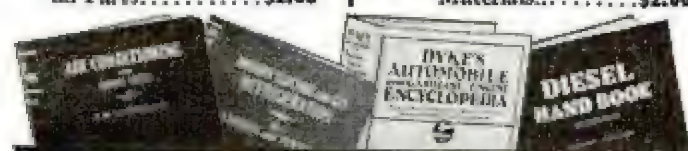
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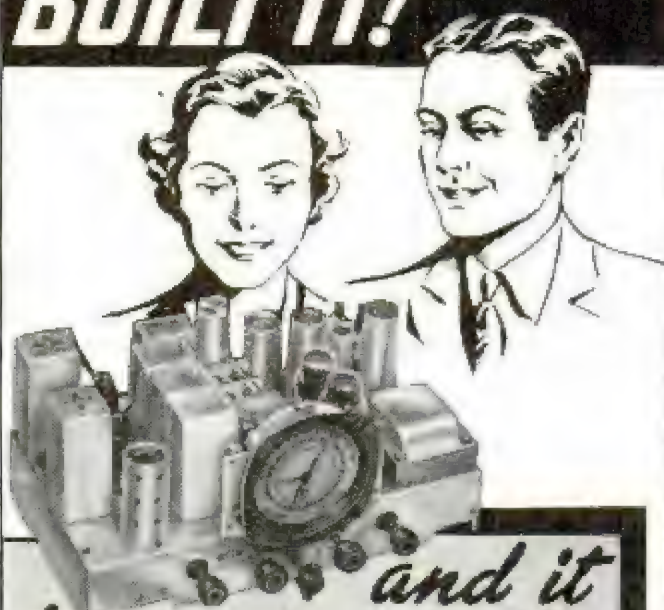
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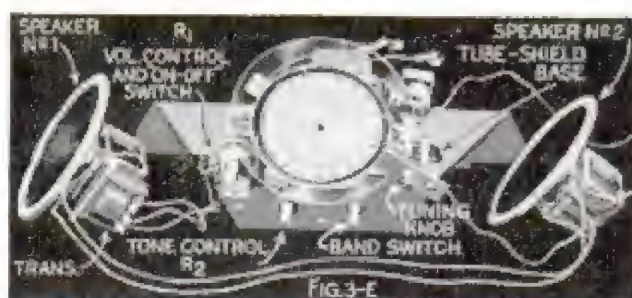
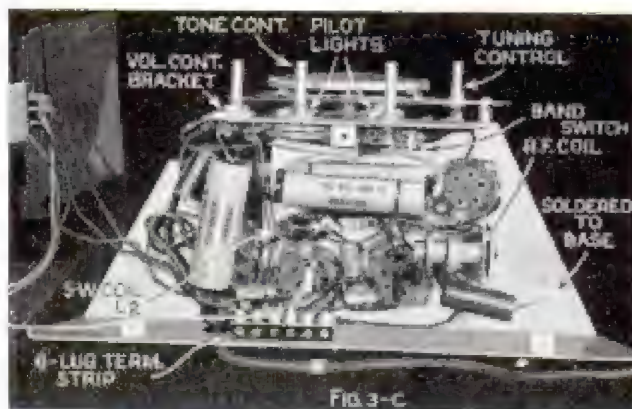
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"Knockabout" Twin-Speaker Set

(Continued from page 739)

diagram in Fig. 2 and a simplified wiring diagram appears in Fig. 3. Photos, Figs. 3-A, 3-B, 3-C, 3-D and 3-E show the parts plainly labeled in their respective positions. The drilled base and twin-speaker cabinet are available for those who do not wish to make their own.

When wiring the circuit care must be taken to connect the electrolytic condensers according to the polarity shown on



the diagrams, otherwise both condensers and the type 25Z5 tube will be damaged. A list of the original materials used can be obtained from Popular Mechanics radio department without charge. The blueprint number is R-244. To balance the set, connect the antenna and tune in some broadcast station at about 1,400 k.c.; tune slightly off this station and adjust trimmers Tr. 1 and Tr. 2 to maximum noise; the receiver is then ready for use.

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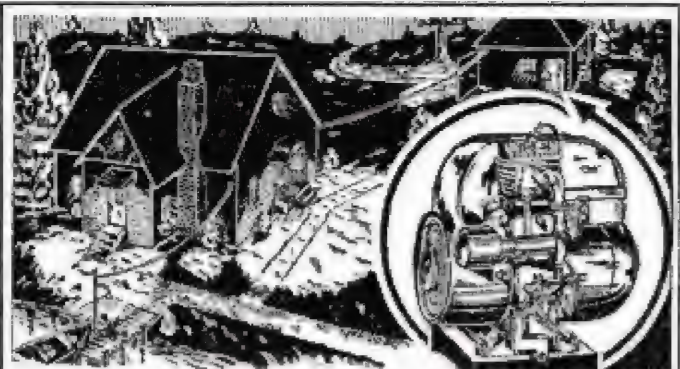


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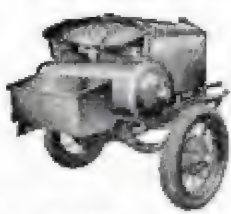
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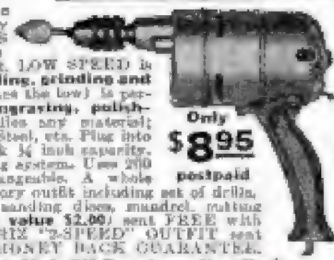
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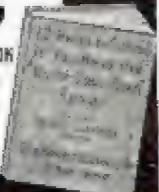
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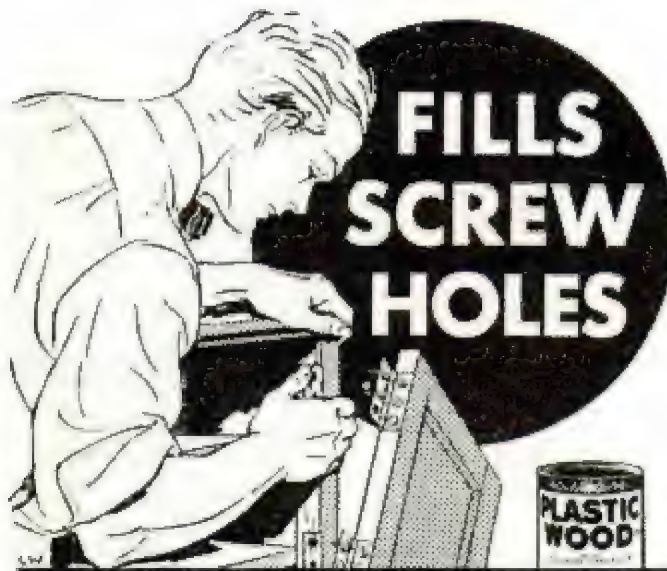
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Pigeons Delayed by Radio Waves

(Continued from page 642)

definite direction after making several spirals, they flutter about, apparently much confused.

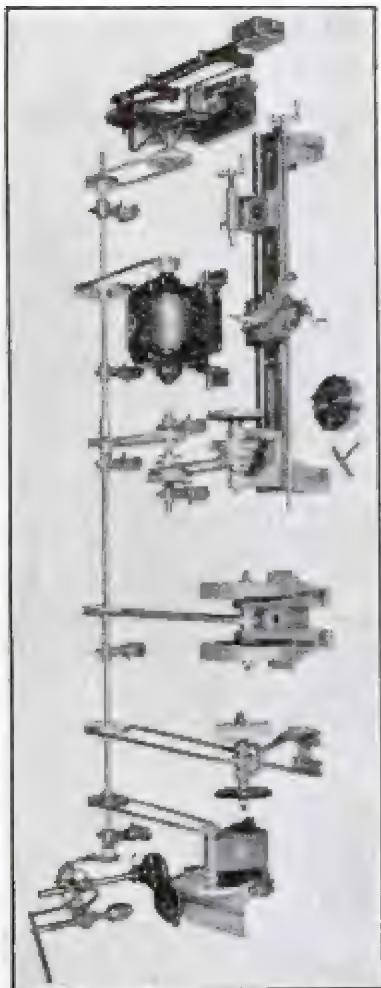
During a series of experiments at Ocean Gate, N. J., pigeons released while short-wave radio was being transmitted from a station near by circled in an erratic manner very close to the station and were from forty-two to fifty-two minutes returning to the loft ten miles away. Pigeons released while the station was inactive made the trip in nineteen to twenty-one minutes.

On three different occasions a group of five pigeons was released while the station was operating and within fifteen minutes a second group was released when the station was not transmitting. By this arrangement the two groups were freed under similar conditions of wind and weather and their flying times were comparable. In the first test, the group subjected to the radio waves fluttered in confusion for fifteen to twenty minutes near the station, then made the ten-mile trip in forty-nine minutes, compared to nineteen minutes for the birds flying free from interference. The second test resulted in a forty-two minute flight for the radio-conscious pigeons and eighteen for those released while the station was not operating. In a third experiment, the group subjected to radio required fifty-two minutes to reach home, the other group only twenty-one minutes.

These experiments, while not entirely conclusive, are regarded as extremely important, since they open a new field for investigation in the largely unexplored subject of short-wave radio. It already has been found that these waves have an effect on human beings. With more and more short-wave stations being built and contemplated, the subject takes on additional interest. It also opens a serious field of investigation regarding the use of pigeons in military operations and suggests the possibility that usefulness of the birds may be curtailed sharply.

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

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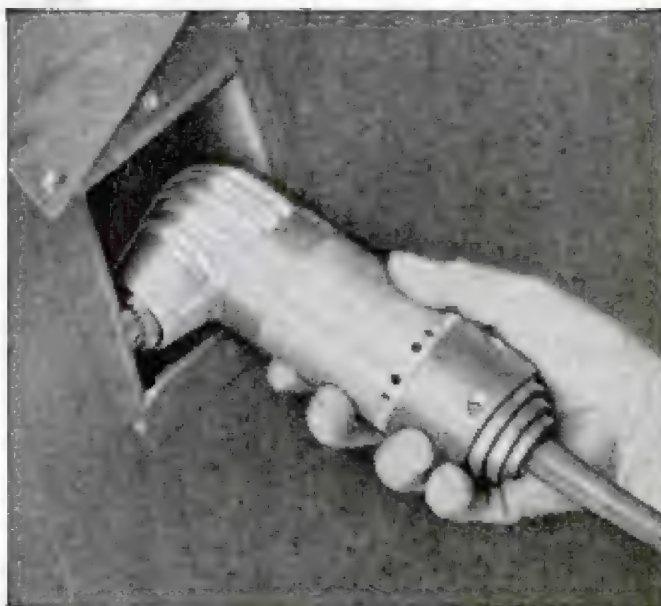


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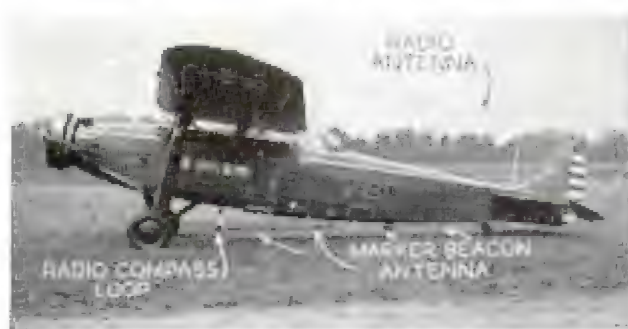
Robot Lands Plane

(Continued from page 645)

ment in commercial and military planes and the radio compass is standard in army planes. With the linking of these devices, it became possible to fly direct to a selected radio station, entirely automatically.

As the plane passes over the outer ground station, a radio marker beacon at the station actuates a receptor on the plane. The receptor impels a wave-length selector which sets the radio compass to 300 kilocycles, the wave length of the second ground station.

The plane, through the action of the compass on the gyro pilot, heads at once for the second station. As the plane passes over the second station, within about five miles of the field, a second impulse from the marker beacon located there, actuates the receptor, again impelling the selector,



Plane used in experimental landings is equipped with three types of radio antennas

this time establishing a wave length of 219 kilocycles for the compass. This is the wave length of the third ground station.

The process is repeated over the third station, which is a little over a mile from the field, so that the compass is tuned to 201 kilocycles, the wave length of the fourth and final station, located just outside the field. As the plane passes over this station, the marker beacon impulse produces manipulation of the controls required in the landing glide.

The plane, which throughout the entire procedure has lost altitude gradually so that it passes over the inner station at between 250 and 275 feet, increases its gliding angle. This control of the glide is effected through coordination of the throttle and the altimeter.

When the wheels touch the ground, a landing gear switch is thrown automatically. This switch is connected with the throttle control to maintain proper idling

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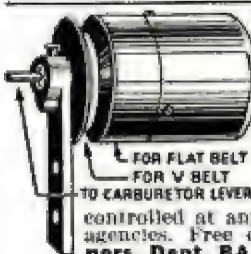
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1054
speed, and with the brakes, so that they are properly applied.

While the ship is coming down, the pilot watches the frequency selector indicator located on the right of the cockpit to verify the correctness of the automatic settings. These settings are the key to the landing procedure, since through them the plane is controlled successively by the four ground stations, which are alined on the flight-path into the field.

This path preferably is due into the wind, but landings have been made with the system under cross-wind conditions as high as eleven miles per hour, and with the air moderately rough at least fifty per cent of the time.

Vital elements in the automatic landing system, besides the interlocking of the radio compass and the gyro pilot, are the marker beacon and its receptor; the wavelength selector, the device coordinating the altimeter and the throttle, and the landing gear switch through which the landing operation is completed.

The marker beacon is an element in the army blind landing system which has been under development for nearly ten years. Blind landings differ from automatic landings in that the pilot actually operates all controls used in landing, but is under a hooded cockpit that makes it impossible for him to see ground or sky.

The beacon throws a vertical pear-shaped field through which the plane must fly to complete either the blind or the automatic landing. In blind landings, the pilot is informed that he is passing over the beacon by a red flash on the instrument panel. In automatic landings, he verifies passage over the beacon by consulting the frequency selector indicator.

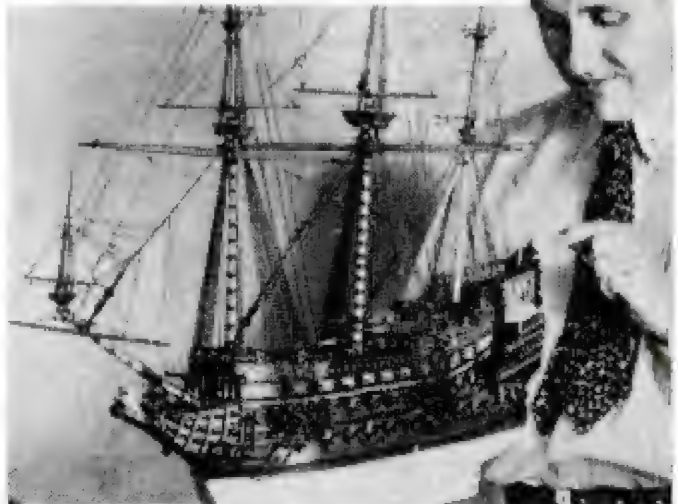
For the first blind landing with the army system, five years ago, Capt. Albert F. Hegenberger of the army was awarded the Collier trophy. At that time only two of the ground stations were used, the landing path being established simply by consulting the radio compass indicator, the altimeter and the artificial horizon. tures built into the automatic landing sys-

Army officials point out that the feature are useful not only for landing but in all flight across radio navigational aids with which the United States is provided. With

(Continued to page 162A)

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(Continued from page 161)

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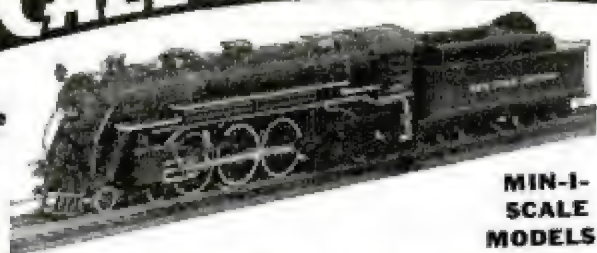
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the equipment, entirely automatic test flights were made from Dayton as far as Texas, and return. Other flights have been made to the army General Headquarters air force base at Langley Field, Va., by way of Buffalo and Newark, N. J., and return, automatically.

Navigational radio aids already installed on air lines and at airports throughout the country have been used on these flights, and may be used by commercial planes bearing the army equipment. For automatic landings, however, these ports would have to be equipped with portable radio guiding stations that are essential to the army system.

The automatic landing system was designed by Capt. Carl J. Crane and Capt. George V. Holloman, assisted by two civilians, Raymond Stout and C. D. Barbulesco. The officers were the only ones in the pilot's seat on the initial series of automatic landings, but they carried disinterested observers to attest the fact that they did not touch the controls. Their difficulty in keeping hands and feet clear is described by the officers as "jittery hands" and "nervous shoe laces."

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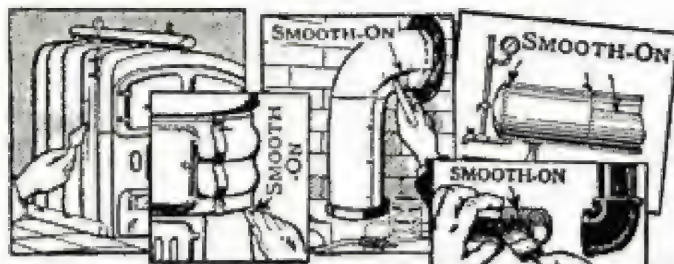
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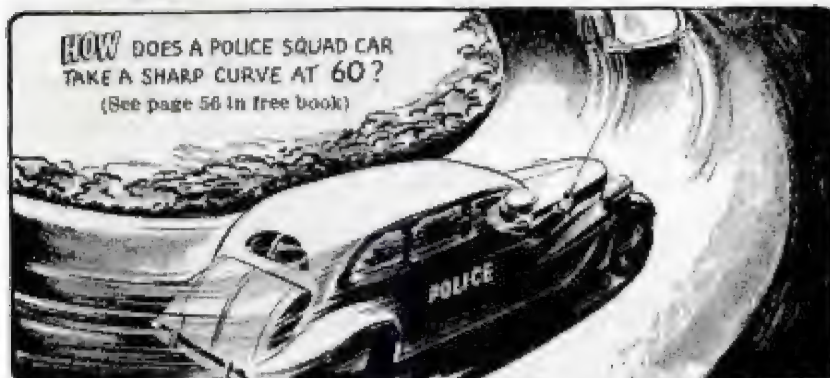
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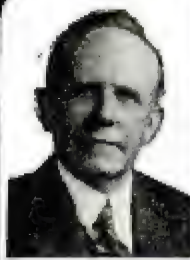


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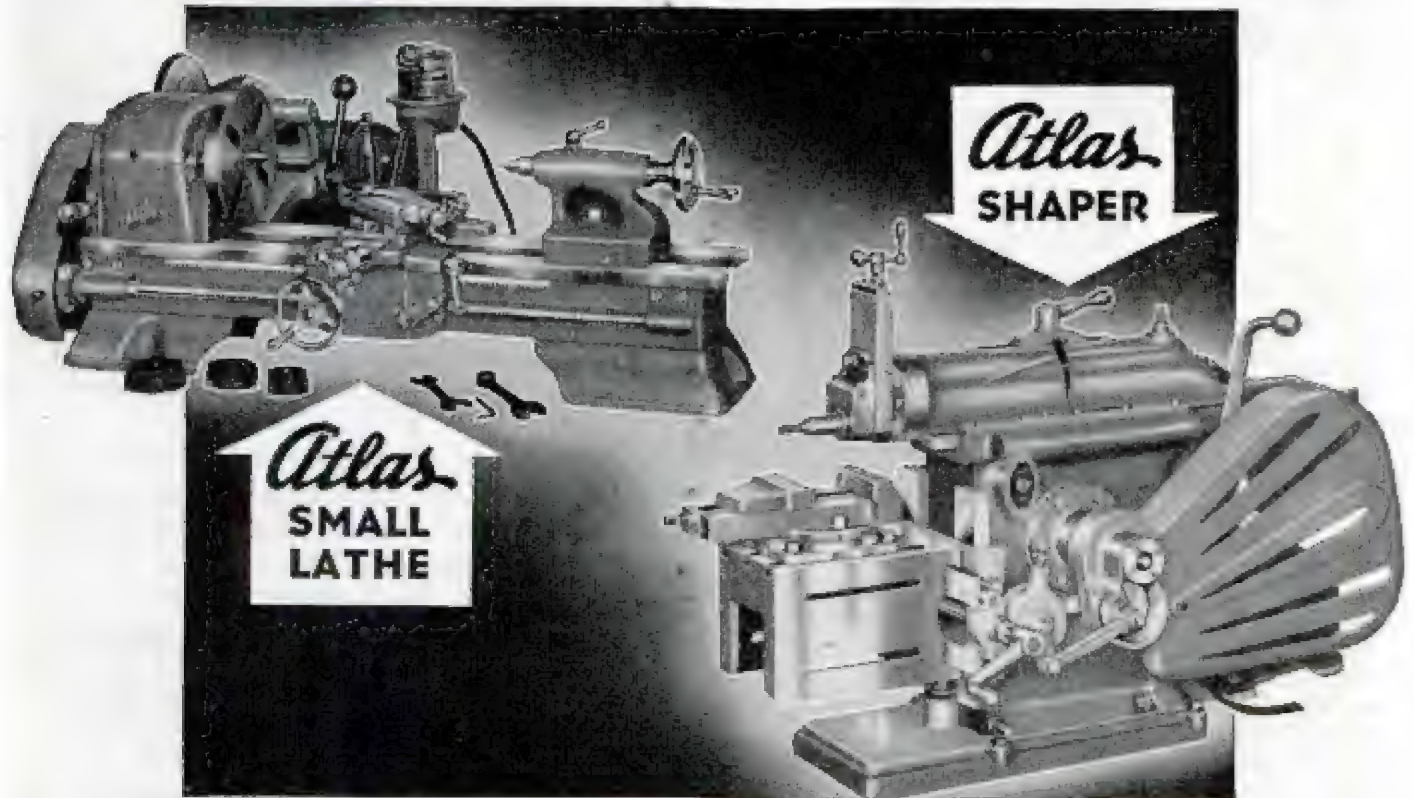
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Atlas

Announces 2 New Precision MACHINE TOOLS



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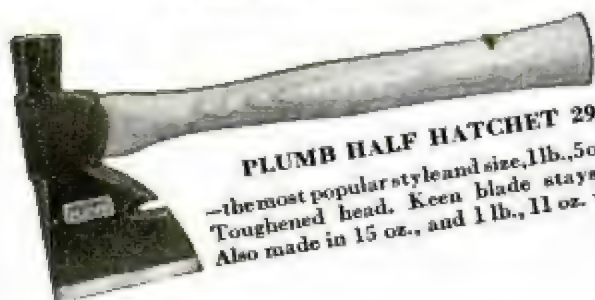
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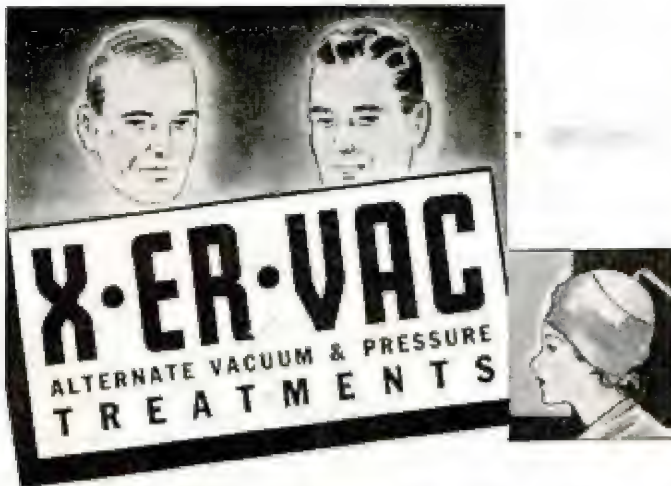
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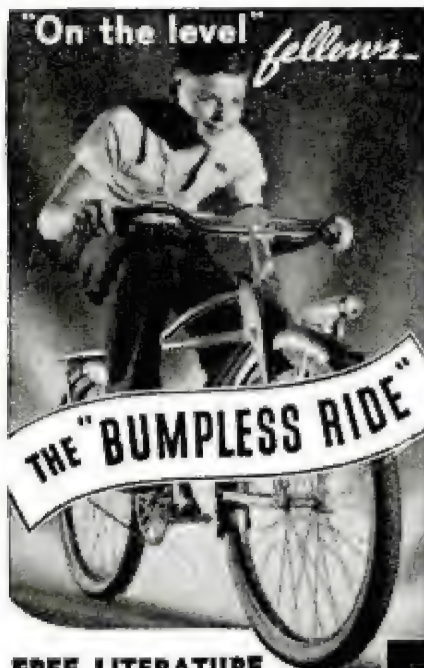
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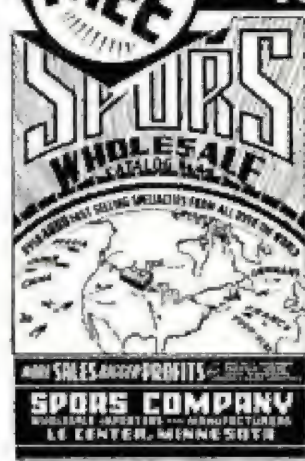
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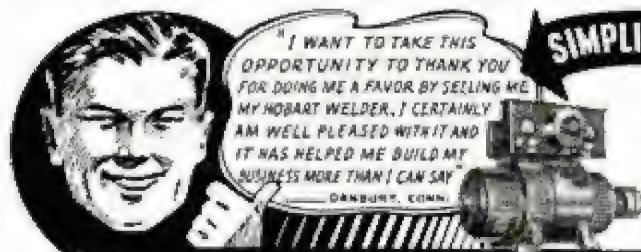
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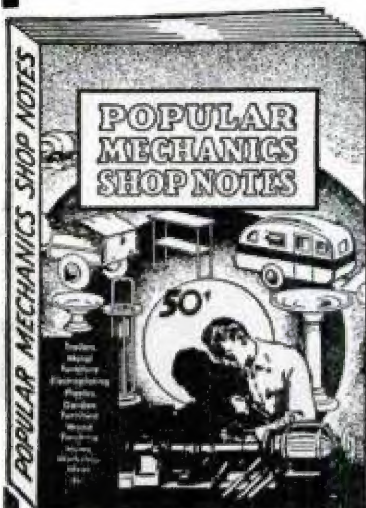
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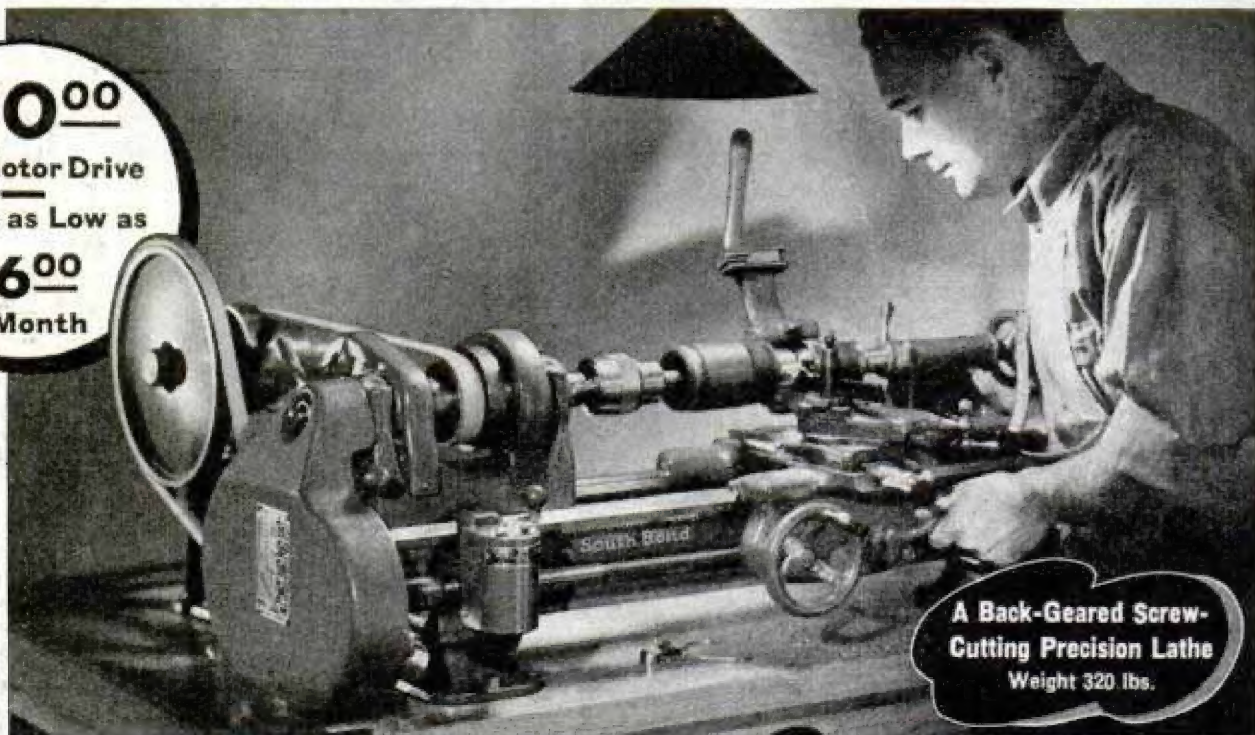
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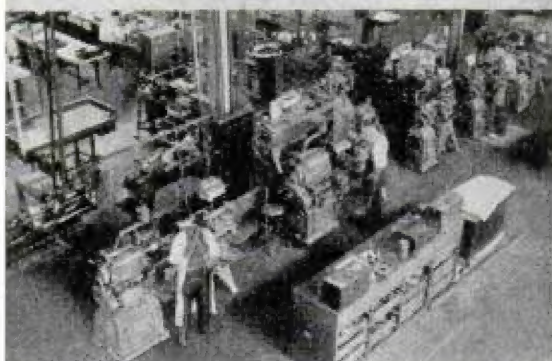
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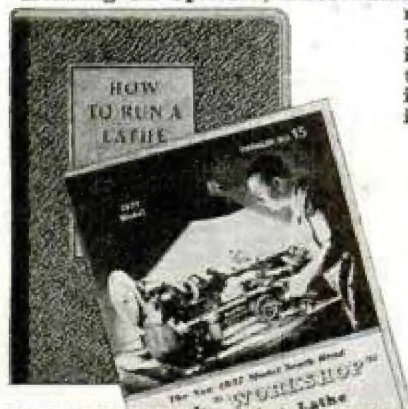
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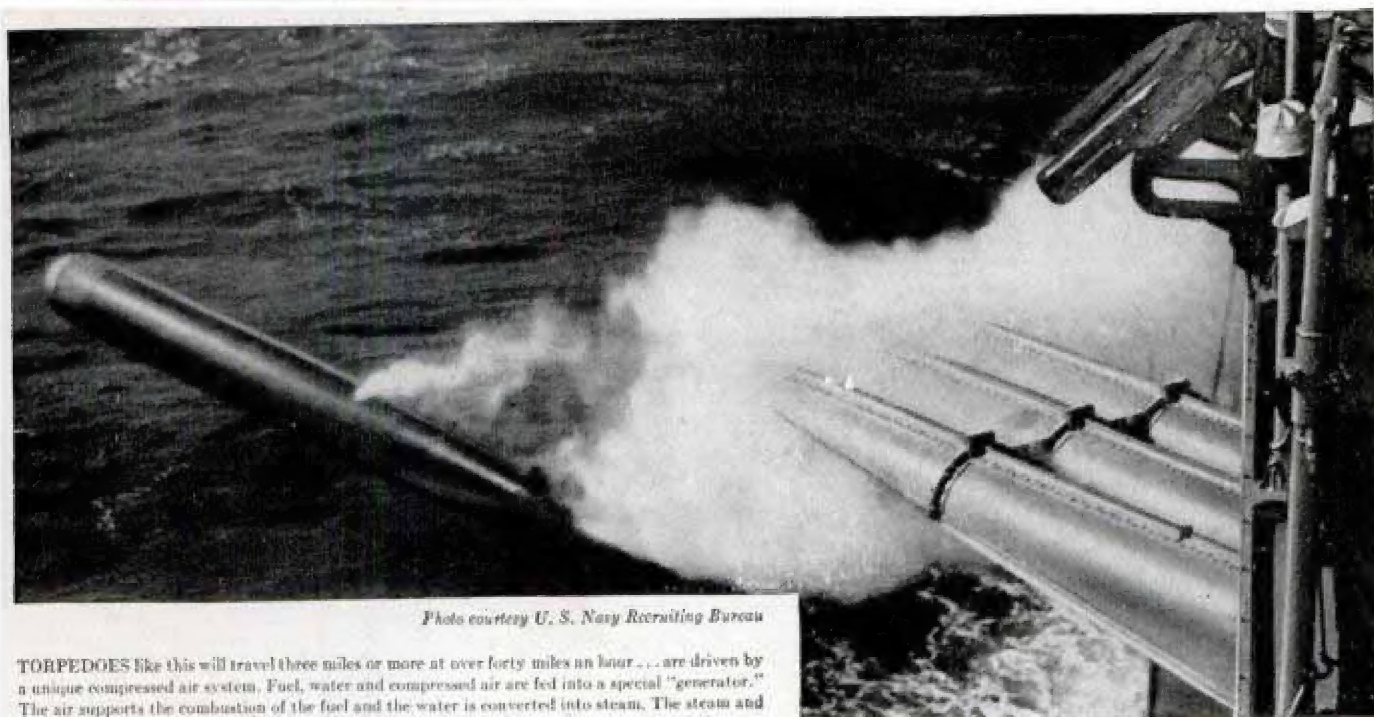


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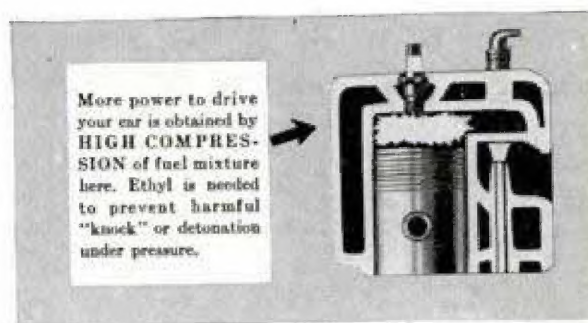


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